



Firearm and Ammunition Terminology



SONORAN DESERT INSTITUTE

SCHOOL OF FIREARMS TECHNOLOGY

© 2022 Sonoran Desert Institute. All rights reserved. The material in this publication cannot be reproduced or redistributed unless you have obtained prior written permission from Trade Training Company, LLC, dba Sonoran Desert Institute.

Sonoran Desert Institute does not assume any responsibility for the use or misuse of information contained in this book.

ISBN: 978-1-945697-42-5

Course materials and other works have been prepared by or on behalf of SDI for general informational and educational purposes only. SDI makes no representations or warranties as to the completeness or accuracy of the information. In no event will SDI be liable for any errors or omissions in the information contained in this work. SDI reserves the right to change, delete, or otherwise modify the work without any prior notice. SDI does not assume any responsibility for the use or misuse of information contained in this work.

A

Accuracy – A term used to describe the ability of a firearm, ammunition or combination of the two to shoot as close to point of aim as possible. Accuracy can be associated with precision although it is not tied to it. A group of shots can be closely arranged around the center of a target without any precision but each individual shot placement can be an accurate approximation of the point of aim. Bad accuracy can be fixed to a degree by adjusting the sights or by accurizing the firearm, which will also increase precision (Figure 0.1).

Accurize/Accurizing – Improving the accuracy of a firearm by carefully hand-fitting or replacing key parts such as the barrel, action, fire control group, grip, or stock. Removing any play or slop in the firearms action and smoothing and polishing any contact points or bearing surfaces will also increase its overall accuracy. Accurizing can also lead to better precision.

Action – The operating mechanisms by which cartridges are loaded, the breech is locked and cases are extracted. Action also describes the fashion in which cartridges are manipulated. For example: break-action, bolt-action, blowback, or gas-operated. The action usually consists of a slide, bolt or breechblock, and feeding and firing mechanisms. Cartridges are loaded either by hand or by some repeatable means such as a magazine. Once fired, the case is extracted and ejected by some method of physical or automatic means.

Action Shooting – A term used to describe shooting sports where competitors shoot targets while on the move, which differs from typical, static bulls-eye matches. Shooters engage targets from behind barricades, or in

different shooting positions, like standing, kneeling, squatting or prone. The competitor usually starts by retrieving or drawing the gun and navigates through a course of fire based on scenario. Scoring is based on a combination of precision and time.

Action (Recoil) Spring – A spring used in repeating, autoloading firearms. The action or recoil spring is usually located behind the action, but in some instances is in front. The action spring is used to feed cartridges and close and lock the breech. When the breech is opened by gas, blowback or other means, the action spring is used to close it again, completing the functioning cycle.

Adjustable Choke – A device attached to the muzzle of a shotgun that allows the operator to rapidly adjust the amount of restriction the choke exhibits on the muzzle end of the barrel. Increasing choke can tighten the way shot patterns and decreasing choke will have the opposite effect. Adjustable chokes will give you the ability to pattern your shotgun based on the specific load.

Air Resistance – The friction or drag that decreases forward momentum of a projectile. The resistance of air will increase as temperature decreases and air becomes denser. This denser air will exert more resistance, effectively limiting a projectile's range and energy. The humidity of the air can also affect its resistance. Since water vapor is less dense than dry air, a projectile will experience far less drag in highly humid air. A bullet's ability to overcome air resistance is defined by its ballistic coefficient.

Air Space – The space between the bullet and propellant inside of a loaded cartridge. Most commercial ammunition contains 10-15 percent airspace. Some types of propellant work more efficiently in the absence of airspace, like with a compressed charge.



Figure 0.1– From left to right: Accuracy without precision– Each shot is an accurate representation of point of aim and the center of the target, but the group as a whole is not tight. Precision without accuracy– Each shot is grouped very tightly together, but they are not an accurate representation of point of aim. Accuracy and Precision– Each shot is grouped very tightly around the point of aim.



Figure 0.2- Various calibers and types of ammunition for pistols, rifles, and shotguns. From left to right: .22 Long Rifle- 40 grain lead round nose, .17 Hornady Magnum Rimfire- 17 grain polymer tipped jacketed hollow point bottleneck cartridge, .32 Automatic Colt Pistol (ACP)- 65 grain jacketed round nose semi-rimmed cartridge, 9x19mm- 115 grain jacketed round nose steel rimless cartridge, 9x19mm- 115 grain round nose brass cartridge, 9x19mm +P- 135 grain rubber tipped jacketed hollow point nickel plated case, .45 ACP- 230 grain jacketed round nose, .45 ACP- 185 grain rubber tipped jacketed hollow point nickel plated case, .38 Special- 125 grain jacketed hollow point rimmed cartridge, .45 Long Colt- 250 grain lead round nose rimmed cartridge, 5.7x28- 40 grain polymer tipped jacketed hollow point bottleneck cartridge, 7.62x39- 124 grain full metal jacket steel tapered bottleneck cartridge, .223 Winchester Super Short Magnum (WSSM)- 40 grain boat tail soft point, .223 Remington- 55 grain full metal jacket boat tail, 5.56x45 NATO- 62 grain jacketed steel penetrator armor piercing boat tail, 30-30 Winchester- 150 grain soft point rimmed bottleneck cartridge, .308 Winchester- 150 grain full metal jacket, .300 Winchester Magnum- 190 grain soft point boat tail belted magnum cartridge, .460 Weatherby Belted Magnum- 500 grain soft point belted magnum cartridge, .410 gauge 2 1/2 in.- 11/16 oz. #6 lead shot, .410 gauge 2 1/2 in.- 1/2 oz. #4 lead shot, 12 gauge 2 3/4 in. 1 oz. lead shot.

Altitude Effect – As altitude increases and air becomes less dense, air resistance decreases resulting in less bullet drag and drop and higher velocity and energy. As altitude decreases and air becomes more dense, drag and drop increase and velocity and energy decrease.

Ammunition/Ammo – An assembly consisting of a case, primer, bullet (or shot), and propellant that comprise a cartridge (Figure 0.2).

Amplitude – The measurement of the magnitude of vibrational movement and its change over time. Amplitude represents the highest and lowest peak of a vibrational or oscillation wave. The amplitude of the oscillations will vary with frequency (Figure 0.3).

Angle of Attack – The difference between where the projectile is pointed and the direction of the flow of air around it. If the projectile's longitudinal axis (tip to base) is perpendicular to the flow of air, it will experience a degree of lift. If the axis is parallel to the flow then it will experience drag (Figure 0.4).

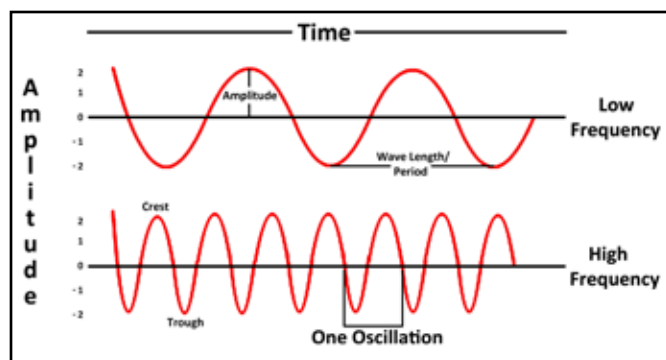


Figure 0.3- The amplitude of a vibrational wave is represented by the travel from the crest to the trough. The greater the magnitude of the amplitude is, the more pronounced the vibrations will be.

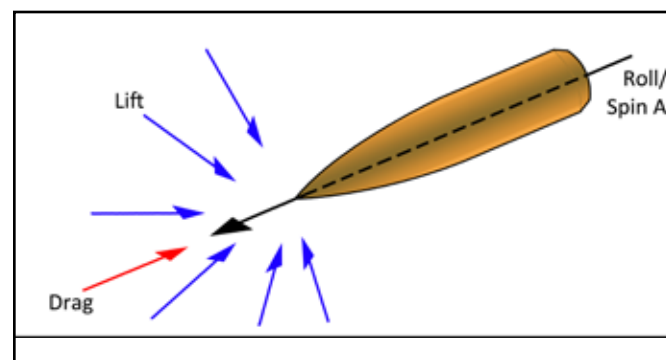


Figure 0.4- A projectile will experience lift at any angle of attack other than directly parallel to the flow of air around it. A projectile will continuously experience drag and lift throughout its travel because air does not flow continuously in one direction.

Anvil – The part of a primer against which the priming mixture is crushed by the firing pin, producing detonation.

Any Other Weapon (AOW) – As described by the BATFE:

- Any weapon or device capable of being concealed on the person from which a shot can be discharged through the energy of an explosive;
- A pistol or revolver having a barrel with a smooth bore designed or redesigned to fire a fixed shotgun shell;
- Weapons with combination shotgun and rifle barrels 12 in. or more, less than 18 in. in length, from which only a single discharge can be made from either barrel without manual reloading; and
- Any such weapon that may be readily restored to fire.

Aperture – The hole, or opening in a peep sight eyepiece, or the eyepiece itself, that allows light to pass through. The aperture acts as a collimator. The smaller the opening in the aperture, the more collimated the light rays become, resulting in a very sharply focused image. The larger the aperture becomes, the less sharp the image appears outside of its focus (Figure 0.5).

Armor Piercing Ammunition – A type of ammunition, typically a bullet, that is designed to defeat barriers and armor such as ballistics vests, concrete, bullet resistant glass, steel and ceramic plates or any other defenses.

Assault Rifle – A selective fire (automatic and burst) rifle or carbine that uses a high power cartridge, has a short overall length (or collapsing or folding stock), and uses high capacity detachable magazines.

Autoloading – A type of firearm whose action automatically ejects and feeds cartridges after the first one has been discharged. Automatic and semi-automatic firearms are autoloading, but only after the first cartridge has been manually chambered. Bolt-action and lever-action firearms are repeaters, but not autoloading because the bolt or lever must be manually operated to cycle the action.

Automatic – A type of action that will chamber, fire, eject and feed cartridges continuously with a single trigger squeeze, until the magazine is empty or the trigger is released.

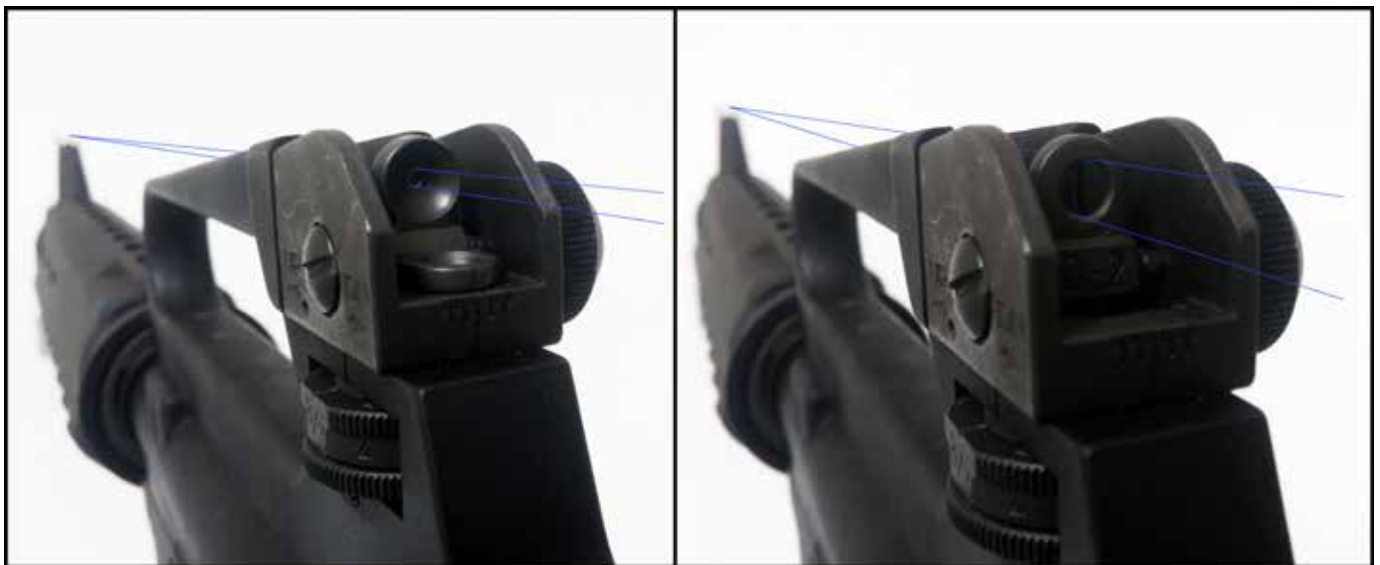


Figure 0.5– The smaller the opening of the aperture is the less likely there will be deviation in sight alignment. Small apertures are very accurate but slow to acquire proper sight alignment. Large openings allow more deviation in sight alignment but are faster to acquire and allow more light to pass through for low light situations.

B

Back-Bore/Back-Bored Barrel – A shotgun barrel whose internal diameter is increased to reduce felt recoil, improve patterning, or change the balance of the shotgun.

Back Strap – The rear portion of a handgun's grip. Sometimes the back strap houses hammer springs or other parts. Some modern semi-automatic pistols feature interchangeable back straps to custom tailor the grip to the shooter's hand (Figure 0.6).

Back Thrust – Load exerted against the breech face when a cartridge is discharged. Although some back thrust is absorbed by the expanding case exerting friction on the chamber walls, much more force is exerted against the inside of the case head, forcing it against the breech face. By knowing the area of the inside of the case head (a) in in., back thrust can be calculated by multiplying it by chamber pressure (p) in pound-force per square inch (psi). For example, the 5.56x45 NATO cartridge has a .323 in. inside case head diameter and a SAAMI peak chamber pressure of 62,000 psi (p).

To generate back thrust figures, first you must calculate the area (a) of the case head. To calculate area (a) we use this formula:

$\text{Pi } (3.14) \times r (\text{radius})^2$

$r = 1/2 \text{ of the diameter } (.323) \text{ or } .162.$

Using our formula for area:

$3.14 \times (.162 \times .162) = .082 \text{ in. inside case head area (a)}$



Figure 0.6– Without the back strap installed the pistols grip is its smallest circumference. Back straps will progressively step up in size and may even feature such features as a beaver tail.

Now that we have our area (a), we multiply it by chamber pressure (p).

$.082 \text{ in. (a)} \times 62,000 \text{ (p)} = 5,084 \text{ psi back thrust.}$

Ball – A round projectile commonly used in muzzleloading firearms. The term is also used within the armed services to describe a projectile with a full metal jacket.

Ball Powder – The trade name for smokeless propellant developed by Olin Industries for the U.S. military. Ball powder can either be flat or spherical in shape. All ball powder is double base and may be fast or slow burning depending on size, and deterrent coatings.

Ballistic Coefficient (BC) – A measurement of a projectile's ability to overcome air resistance. Ballistic coefficient approximately calculates how efficient a bullet is at defeating drag, drop, wind, and other forms of drift. Bullets that feature longer, pointed noses, longer bodies, and greater mass will have a higher ballistic coefficient. A high number indicates a lower deceleration from outside forces. Ballistic coefficient is a product of mass, drag coefficient, sectional density, and diameter of the bullet (Figure 0.7).

Ballistics – The science of motion, behavior, and effects of projectiles from the moment of ignition to the point of impact. Interior ballistics deals with what is happening inside the chamber and bore of the firearm. Transitional ballistics is the behavior of the projectile and expanding gases exiting the muzzle. Exterior ballistics deals with the bullet's flight. Terminal ballistics deals with a projectile's performance on impact.

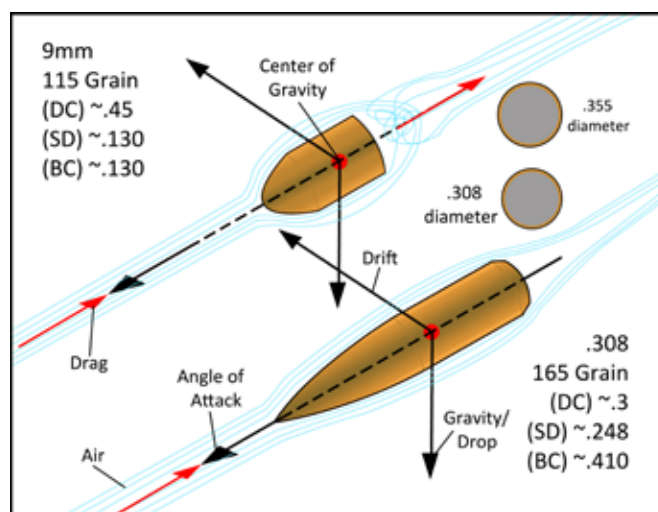


Figure 0.7– A projectile with a high ballistic coefficient (BC), high sectional density (SD) and low drag coefficient (DC) will overcome air resistance more efficiently than a projectile with a low BC, SD and high DC. A projectile like the .308 will disrupt the air around it less than a 9mm, allowing it to fly flatter and further.



Figure 0.8- The barrel channel can either support the barrel with a tight fitment, or allow it to free float with a loose fitment. Both have benefits and are a matter of preference.

Barrel – The part(s) of a firearm through which bullets, shot, or other projectiles are forced through. Projectiles travel from breech to muzzle, through the bore. A barrel consists of a chamber, bore, rifling and muzzle. The barrel is constructed from some type of steel alloy. Some barrels feature provisions for sights or other accessories.

Barrel Adapter – A small section of barrel that has an integral chamber. A barrel adapter is inserted into a larger chamber and barrel, permitting it to fire a smaller caliber cartridge.

Barrel Band – A metal strap on a rifle that secures the barrel to the stock or magazine tube.

Barrel Bushing – A short sleeve in the muzzle end of a semi-automatic pistol's slide designed to support and secure the barrel. It may be fixed (Browning) or removable (Colt).

Barrel Cam – A camming surface on the barrel or frame that serve to allow the barrel to pivot up and down and back and forth to lock and unlock the breech.

Barrel Channel – The groove in the forward portion of a rifle stock that accommodates the barrel (Figure 0.8).

Barrel/Cylinder Gap – The space between the barrel and the cylinder of a revolver, essential for reliable operation. The gap is normally about .003 in. – .012 in. A gap larger than .012 in. will allow a larger amount of gas to escape and may create a potentially dangerous situation.

Barrel Erosion – The deterioration of the barrel's throat and rifling by friction, high pressure, and hot propellant gases. Since the throat, lede, and rifling have been worn away, their dimensions become larger. Instead of the

bullet having to span a small gap to reach the rifling, it will wobble until it meets what is left of the rifling. Erosion reduces accuracy and it may prevent bullets from fully stabilizing. Erosion is dependent on the energy the cartridge produces. For example: A .22LR that produces about 24,000 psi chamber pressure will yield less wear than a .308 Win.ter that produces about 62,000 psi chamber pressure.

Barrel Extension – A tubular addition to the chamber end of a barrel. The extension will usually feature channels or lugs that coincide with lugs on the bolt. The bolt will ride past the extension lugs and rotate. When the bolt rotates, its lug will align with the extension's lugs, and lock the breech. Barrel extensions are commonly found on rifles, but there are some pistols that use a rotating bolt and extension (Figure 0.9).

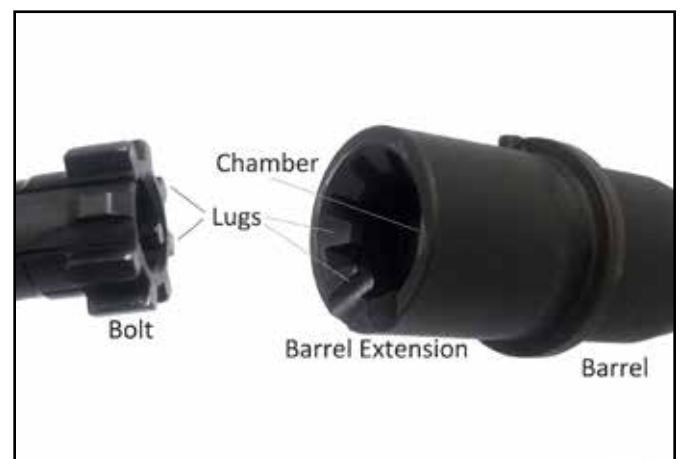


Figure 0.9- The lugs on the bolt coincide with the slots in the barrel extension. When the bolt rotates inside the extension, its lugs will align with the extensions and lock the chamber closed.

Barrel Flats – On break-action side-by-side shotguns, the bottom of the breech end of the barrels. When the action is closed, the barrel flats rest against the flats on the receiver.

Barrel Harmonics – The behavior of a barrel when dealing with a series of pressure, shock, sound and vibrational waves. When a cartridge is discharged, there are an array of impulses that move through the barrel and receiver. One cause of these impulses comes from the pressure of the propellant when it ignites and expands. The velocity of the gas expansion can be upwards of 2 – 2.5 times the muzzle velocity. A projectile traveling at 3,100 fps is propelled by gas that is expanding at roughly 6,200 fps and 62,000+ psi chamber pressure. The speed of sound is approximately 1,125 fps in air. Since the gas is expanding at around five times (Mach V) the speed of sound, there are a series of shock waves that are created. These waves will oscillate the length of the receiver and barrel 10 –12 times before the bullet exits the muzzle. This all happens in about .0025 seconds.

The force that is created from the bullet traveling through the rifling will also impacts its harmonics. The action of rotating a bullet to the right (clockwise) has a counterclockwise force applied to the barrel as the reaction. As the bullet travels through the rifling it causes the barrel to precess. The circular, writhing motion of the muzzle causes the bullet to leave at different points of its path. This is why three shot groups will form a triangle.

Even something as small as the hammer striking the firing pin will transfer sound waves. These waves will transfer from the action to the barrel and cartridge. The

speed of sound through steel, copper, brass, and lead is 20,000, 12,800, 11,400, and 3,800 fps, respectively. All of the different types of metals will vibrate at different frequencies and amplitudes that bounce around and affect the barrel and action in various ways.

Barrel composition, design, process of manufacturing, stress and heat treatments, the load being used, and temperature can all affect the barrels harmonics. Barrels made stiffer from harder steel with uniform grain structure, with thicker walls and shorter lengths, usually provide better harmonics because they are stiffer and transmit smaller precessions. Also referred to as disharmonic resonance (Figure 1.0).

Barrel Liner – A thin-walled, rifled tube used to reline worn barrels or switch to another caliber. To install a barrel liner the bore must first be drilled out to accept the liner. Once the bore is drilled out and all surfaces are cleaned, the liner is set into the barrel with either solder or epoxy. Liners are usually reserved for small caliber, rimfire cartridges.

Barrel Link – A short, pivoting part that's pinned to a lug on the bottom of the barrel. During cycling the link pulls the barrel down, unlocking it from the slide. Barrel links are found most commonly in 1911-style pistols.

Barrel Lug – A projection from the barrel that is used to mount parts or operating mechanisms or accessories.

Barrel Profile (Contour) – Refers to a barrel's outline or silhouette. A combination of various outside diameters, steps and tapers. Barrel contours can range from

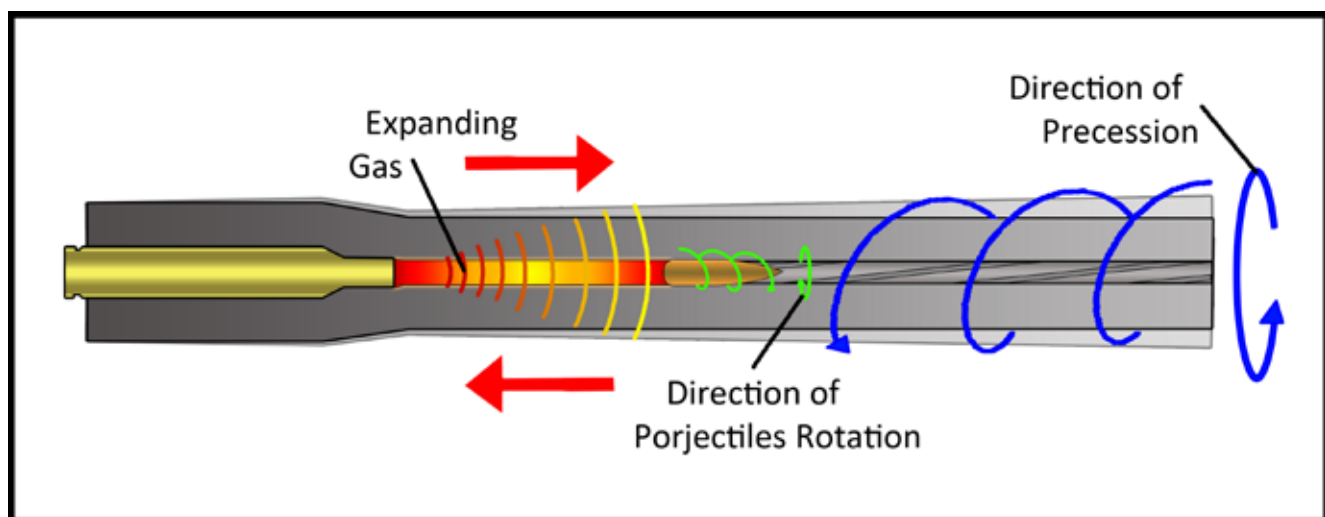


Figure 1.0- There is an array of forces acting upon the barrel when a cartridge is discharged. The stiffer a barrel is, the better it can handle these forces and resist precession.

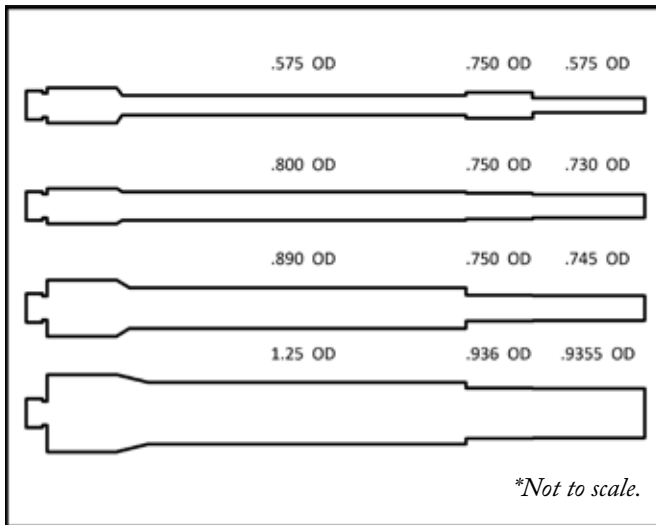


Figure 1.1- Four barrels of equal length with different profiles. From top to bottom: A light weight or "pencil" barrel- Very light weight but not very stiff. A standard profile barrel- A good compromise of weight and stiffness. A medium contour barrel- Slightly more weight than a standard profile barrel but much stiffer. A heavy or "bull" barrel- Very heavy but also very stiff.

featherweight (.550 in. outside diameter) to bull (1 in. and up outside diameter), depending on caliber (Figure 1.1).

Barrel Tang (Hood) – The protrusion on top of the breech end of a semi-auto pistol barrel. The tang or hood locks into a corresponding notch in the slide when the pistol is in battery.

Barrel Tenon – The portion of the barrel near the breech and chamber that attaches to the receiver. The tenon is usually threaded, but sometimes it is pressed into the receiver.

Barrel Throat – 1. The area just forward of the chamber that guides the bullet into the rifling. 2. A funnel-shaped area comprising part of the feed ramps at the rear of the chamber on some semi-auto pistols (Figure 1.2).

Battery (In/Out) – 1. In battery is when there is a round in the chamber, the action is locked, and the firearm is ready to discharge. Out of battery is a condition when there is a round in the chamber and the firearm is ready to discharge but the action is not completely closed or locked because of a malfunction or debris. Firing out of battery can be a dangerous condition because it can result in high pressure gas being vented out of the breech of the firearm, where the operator is. This high pressure venting can rupture the cartridge case and deform the frame of the firearm, potentially creating flying shrapnel. 2. A term used to describe a collection of firearms used to accomplish a common goal. A battery of firearms for 3-gun competition might include a 9mm, or .45 caliber semi-auto pistol, a pump, or semi-auto 12-gauge shotgun, and an AR-15-style semi-auto rifle.

Battery Cup Primer – A type of primer used in most shotgun shells. Shotgun primers are larger than rifle or pistol primers so they feature a two-part design with the primer cup and anvil being reinforced by a larger cup.

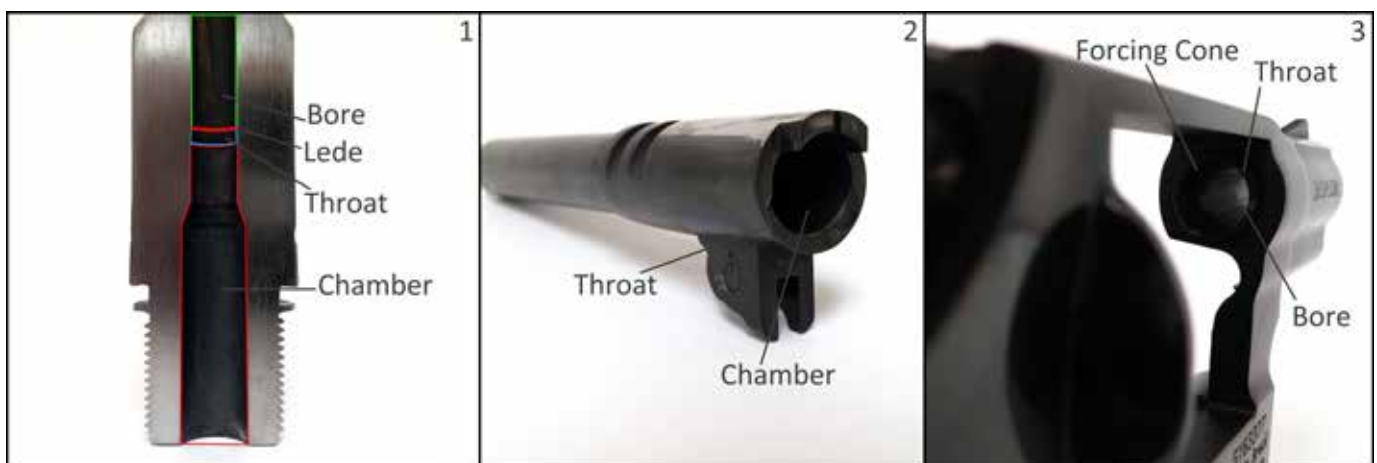


Figure 1.2- 1. In a rifle barrel the throat serves to guide the projectile from the cartridge case into the bore. 2. In a semi-automatic pistol barrel the throat serves to guide a cartridge into the chamber in preparation for firing. 3. In a revolver barrel the throat serves to guide the projectile into the bore from the chamber, past the cylinder gap.

Bearing Surface – 1. The exterior surface of a bullet that contacts the barrel's bore or rifling when fired. Too little bearing surface can affect accuracy by allowing the bullet to cant while travelling through the bore. Too much bearing surface can reduce velocity. 2. Any surface where two components ride, slide, or move against each other.

Beavertail – 1. A wide extended tang at the rear of semi-auto pistols designed to protect the web of the hand from contact with the hammer. The beavertail prevents a condition known as "hammer bite." Also, the beavertail provides better support and more gripping surface. 2. A wider than normal forend on a rifle stock. The forend beavertail is also used to provide a better grip.

Bedding – Refers to the fit between the barrel and action of a rifle to its stock. Also used to describe the process of creating a tighter fit between the stock and action with the use of reinforced epoxy known as glass bedding. Tight bedding of a rifle's action to its stock results in better accuracy and precision because it eliminates wobble in the rifle.

Belt Fed – A term used to describe a firearm that uses a strip or band of ammunition as its feeding device.

Belted Case – A cartridge case that has a raised band at the base. The belt strengthens and reinforces the case and headspaces the cartridge inside the chamber (Figure 1.3).

Bench Rest Rifle – A rifle that is designed for maximum precision. Usually features a heavy or bull barrel and is usually shot from a fixed bench rest, eliminating human error.



Figure 1.3- In addition to strengthening the case in one of its weakest points, the belt also serves as the shoulder on which the case headspaces against.

Berdan Primer – A type of primer that uses an anvil incorporated in the case rather than the primer body. A Berdan primer can be identified by the two flash holes inside the primer pocket. Created in the 1860s by Col. Hiram Berdan.

Big Bore – Usually refers to rifles of .30 caliber or greater and pistols of .38 caliber and greater.

Bipod – A support device with two legs. The bipod permits the operator to rest the firearm on the ground, a low wall, or other object, reducing operator fatigue and permitting increased accuracy from reduced motion.

Black Powder – The first known chemical explosive and the earliest small arms propellant. Black powder is thought to have been invented by the Chinese over 1,000 years ago. Black powder is made from saltpeter (potassium nitrate), charcoal, and sulfur. Today, black powder is used only in muzzleloading firearms. Black powder is also known as gunpowder.

Black Powder Substitute – A propellant that is designed to reproduce the burning rate and properties of black powder (making it safe for use in black powder firearms). It provides advantages in several areas such as reduced smoke, reduced corrosion, reduced cost, or decreased sensitivity to unintentional ignition.

Blank – A type of cartridge that contains a reduced amount of propellant but no bullet. When fired, the blank makes a flash and noise. Blanks are used for simulation, training, and signaling.

Blind Magazine – A type of non-detachable box magazine that is concealed within the stock of a rifle. Also known as an internal or fixed magazine.

Blowback Action – A type of action that cycles a firearm using energy from expanding gas to force the cartridge case against the bolt or slide to the rear. The bolt or slide does not typically lock into the breech with lugs or cams; rather, the breech is securely closed by the inertia generated by the recoil spring and the mass of the bolt assembly. Blowback action works like a simplified gas operation, with the bore acting like a gas tube and the case acting as a piston.

There are many forms of blowback action from straight to delayed, but they all operate on the same principal, the only difference is the way bolt movement is controlled. There are many types of firearms ranging from .30 caliber machine guns to .22 caliber rimfire pistols that use some form of blowback action. Most blowback-operated pistols are small caliber, such as .22 and .380, and most blowback rifles are between .22 and 9mm.



Figure 1.4- The boat tail's design reduces friction on the bullet's bearing surface as it travels through the bore, but may not have enough contact with the rifling to properly align it. In flight its design experiences less drag and will experience less deflection from wind. A boat tail bullet will retain more velocity and energy than a flat-based bullet as well as have an extended effective range.

Boat Tail – A type of bullet with a tapered base. They are usually long and slender with a high ballistic coefficient. Used for long range and match applications (Figure 1.4).

Bolt – The assembly that houses the firing pin and extractor and locks the cartridge into the chamber. The bolt serves the same purpose as the breechblock. The process of the bolt locking can either be accomplished manually or automatically.

Bolt-Action – A type of firearm action consisting of a cylindrical bolt that is manually locked and unlocked by manipulation of a small handle. Manually cycling the bolt also cocks the firing pin, feeds the rounds, and after firing, ejects the case (Figure 1.5).

Bolt Carrier – A part used on some semi-automatic firearms that houses the bolt head. Firearms that employ a rotating bolt or similar method to lock their breech usually utilize a bolt carrier that literally carries the bolt head through its travels. The bolt head is allowed to move freely to lock and unlock the breech while the carrier oscillates inside the receiver to open and close the action.



Figure 1.5- 1. A very nice example of a custom bolt-action rifle. Built on a Remington 700 action and chambered in 6mm Remington. 2. The action is closed and the chamber is locked. With a round in the chamber the rifle is ready to fire. 3. The action is open; a fired cartridge case has been extracted and ejected. The rifle is ready to feed a new cartridge and fire another round.

Rifle built by David Service of Danger Close Armament in Lakewood, Colorado.



Figure 1.6- The closer an operator can get their hand in line with a firearms bore axis, the better their ability to control recoil and muzzle flip will be. The further away the hand gets from the bore axis, the more prominent recoil and flip will be.

Bolt Face – The part of the bolt that supports the cartridge case head when chambered. There is a hole in the bolt face to allow the firing pin to pass through and a notch around its exterior to facilitate an extractor.

Bolt Guide – The track that the bolt rides in during travel. The guide is usually a protrusion from the bolt that rides in a channel in the receiver, or vice versa.

Bolt Thrust – The pressure that is exerted against the bolt face from the cartridge while firing. Also known as breech pressure or back thrust.

Bore – The internal surface of a firearm's barrel. The diameter of the bore depends on the caliber used. Bores may either be smooth or rifled depending on the type of firearm.

Bore Axis – The imaginary centerline of a barrel's bore. The axis runs from the barrel's breech end to its muzzle end. Usually, the higher the grip or support is in relation to the bore axis, the easier it is to control recoil. A high bore axis in relation to grip will act as a lever impacting more perceived force the higher the axis gets (Figure 1.6).

Bore Build-Up – The accumulation of propellant and metal fouling residue from continually firing without cleaning.

Boresnake – A tool used to clean the bore of a firearm. A boresnake is a braided cord with integrated brushes of metal or nylon. The boresnake is coated with cleaning solvent and pulled through the bore from the chamber to the muzzle several times.

Boresight – The traditional method of aligning sights by viewing a centered target through the firearm's bore. With the firearm mounted firmly and while looking through the bore at a centered target, adjust your sights until they are aligned with the same point of aim. There is also a tool that is called a boresight that is used to align the sights. There are two main types of mechanical type of boresights: optical and laser. The optical boresight resembles a scope but it uses a collimator attached to the barrel. These boresights will typically feature a grid pattern that is used to align the sights against. The laser boresight has two basic configurations: universal and caliber specific. The universal model will use an arbor(s) to align itself inside the bore. The caliber specific model is shaped like a cartridge and is inserted into the chamber. With a laser boresight the sights are aligned with the dot. Whatever method is used, the operator will still have to fire live cartridges to verify zero. Boresighting can be a very good way of finding an approximation of where the firearm will shoot, but there are too many factors involved to exactly pinpoint the projectile's trajectory.

Borescope – A tool for examining the bore or chamber of a firearm. A borescope will typically consist of a tube, mirror, light source, and the lens that is inserted through the chamber or muzzle. There are also modern borescopes that use digital cameras and can be viewed through a television or computer.

Bottleneck Cartridge – A cartridge named so because of its resemblance to a drink bottle with a larger diameter body, tapered shoulder, and a smaller diameter neck (Figure 1.7).



Figure 1.7- Several examples of bottleneck cartridges. From left to right: .17 HMR, 5.7x28, 7.62x39, .223 WSSM, .223 Remington, .300 Win Mag, .460 Weatherby Magnum.



Figure 1.8- Various types of box magazines. 1. Single stack pistol magazine. 2. Casket magazine for a rifle. 3. Single stack pistol magazine in a double stack body. 4. Double stack pistol magazine. 5. Rotary box rifle magazine. 6. Double stack rifle magazine.

Box Magazine – A rectangular five-sided box that is used to feed stacked cartridges into a firearm, usually a rifle. Box magazines are usually detachable and sometimes mislabeled as “clips” (Figure 1.8).

Boxer Primer – A type of primer with its own self-contained anvil pressed into the cup. They are the standard type of primer used in all U.S. manufactured centerfire ammunition. Named after the inventor, Col. Edward Boxer.

Brass – A term to describe empty cartridge cases. Also an alloy of copper used to manufacture those cases.

Break-Action – A firearm action that uses barrel/s that are hinged on the receiver, and rotate perpendicular to the bore axis to expose the breech. The firearm will “break” open to allow loading and unloading of cartridges (Figure 1.9).

Breech – The section of a firearm that is comprised of the essential functioning parts: action, firing mechanism, magazine, and chamber. The breech is also the portion of the firearm where cartridges are inserted.



Figure 1.9- A double barrel, break-action 10 gauge shotgun. Top: The action is closed, the breech is locked, hammers are cocked and the shotgun is ready to fire. Bottom: The action is open, cartridges have been extracted and it is ready to load and fire again.

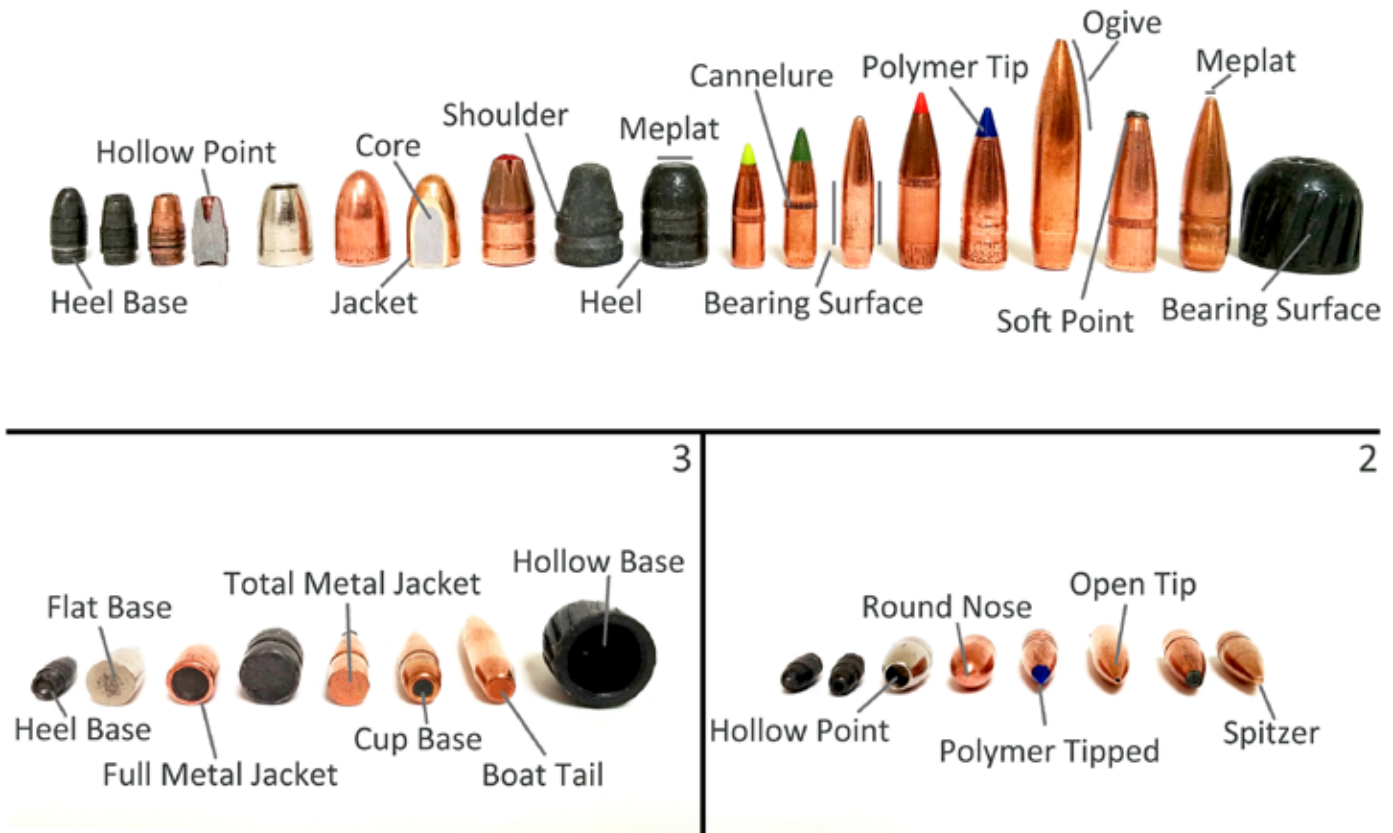


Figure 2.0– 1. A selection of pistol, rifle and shotgun bullets. From left to right: .22 caliber 40 grain lead round nose, .22 caliber 36 grain lead hollow point, .22 caliber 36 grain plated hollow point, .22 caliber 36 grain plated hollow point cutaway, .355 (9mm) caliber 50 grain plated copper hollow point, .355 caliber 115 grain jacketed round nose, .355 caliber 115 grain jacketed round nose cutaway, .355 caliber 135 grain polymer tipped hollow point, .45 caliber 255 grain lead semi-wadcutter, .45 caliber 300 grain lead flat nose, .223 (.224) caliber 55 grain polymer tipped hollow point, .223 caliber 62 grain steel penetrator, .223 caliber 75 grain open tip, .270 (6.8) caliber 110 grain polymer tipped hollow point, .308 caliber 110 grain polymer tipped hollow point, .308 caliber 220 grain open tip, .308 caliber 150 grain soft point, .311 (7.62mm) caliber 124 grain full metal jacket, 12 gauge (.729 caliber) 1 oz. Foster rifled slug. 2. Various types of bullet tips. 3. Various types of bullet bases.

Breechblock – Used in single-shot firearms. Part of the breech assembly that locks the action against the barrel and contains the pressure of a fired cartridge.

Breech Bolt – The part of the breech that locks the chamber closed during discharge.

Breech Face – The portion of a revolver frame or semi-auto pistol slide that supports the cartridge head during firing. The breech face serves the same purpose as the bolt face.

Breech Pressure – See *Back Thrust*.

Broach Rifling – A type of cut rifling that uses a single tool that uses multiple cutting surfaces around its circumference. The broach is either pushed or pulled through the bore while spiraling. Each successive set of teeth cuts deeper than the previous. The last sets of teeth remove very little material and leave a very smooth surface. The process of broaching imparts very little stresses on the barrel during manufacturing and creates very uniform rifling.

Buckshot – Round balls ranging in diameter from .25 in. (# 3 buckshot) to .36 in. (000 buckshot). Buckshot is primarily made of lead or lead alloy but sometimes it may feature a copper jacket. Buckshot is used in shotshells and used for close range big game hunting or self-defense.

Bull Barrel – A term to describe the contour of a barrel with very thick walls and a large outside diameter compared to standard barrel dimensions. Bull barrels refer to barrels with an outside diameter of 1 in. or greater the entire length.

Bullet – A cylindrical projectile usually composed of lead or lead alloy. Most modern bullets' tips are conical in shape, but can also be round, flat or semi-flat, and hollow. There may also be cannelures around the circumference of the bullet's body and its tail may be tapered. Some bullets are also fully or partially covered with a thin metal jacket (Figure 2.0).

Bullet Deflection – The directional change produced when a bullet strikes an object and is averted from its original path. Also known as a ricochet.

Bullet Energy – Kinetic energy usually expressed in foot-pounds force (ft-lbf), at specific distances of the projectile's travel. Bullet energy is usually measured at the muzzle, at 100 yd. and beyond in increments of 100 yd. (200, 300, 400, etc.). To calculate bullet energy you must know the bullet's weight (w) in grains and velocity (v) in feet per second at a given distance. Bullet energy can be calculated two ways with these equations: Number 1 being the simple calculation for muzzle energy. Number 2 is the equation for kinetic energy modified for bullet energy:

1. Velocity (v) squared X bullet weight (w) in grains, divided by 450,436(constant)* = energy.

Example: $3,100(v) \times 3,100(v) \times 62(w) / 450436 = 1,322.76 \text{ ft-lbf}$.

2. $\frac{1}{2}$ the weight (w) in grains X velocity (v) squared, divided by 7,000**, divided by 32.174***.

Example: $(.5 \times 62(w)) \times (3,100(v) \times 3,100(v)) / 7,000 / 32.174 = 1,322.76 \text{ ft-lbf}$.

*2 x 32.174 X 7,000, ** 1 pound = 7,000 grains, *** 32.174 = gravitational acceleration

Bullet Engraving – A series of channels cut along the outside circumference of a fired projectile. These channels are impressed onto the bullet by the rifling. These engravings are unique to the firearm from which the projectile is fired. The size, shape, and type of rifling, as well as burrs from cutting the rifling, can be imprinted onto the projectile's surface, creating a unique “fingerprint” that can be used to match it to the firearm that it was discharged from.

Bullet Mold – A piece of equipment for reloading that is used to produce bullets. A bullet mold features bullet-shaped cavities that are filled with molten lead or lead alloy. Once hardened, the mold is opened or separated to release the bullets.

Bullet Pull – A measurement of how tightly the neck of a case grasps a bullet after crimping. Bullet pull can be used to affect burn rate to a small degree. The increased tension on the bullet will require more pressure to push it out of the case, allowing the propellant more time to burn. Consistent bullet pull from round to round will also ensure a degree of precision.

Bullet Puller – A tool used to remove bullets from loaded cartridges. The cartridges are secured into the puller that is somewhat hammer shaped. The cartridge sits on one end of the head, bullet down. The other end is struck on a hard surface. The puller relies on the bullets mass and the kinetic energy generated by the puller striking the ground to extract the bullet. Pullers are used to fix mistakes that may be made when reloading, such as forgetting to add propellant.

Bullet Trap – A device used to capture projectiles fired intentionally or unintentionally. A bullet trap may be used as an improvised shooting range or as a safety device used by police or other operators when clearing a firearm to make safe. Bullet traps can be made from metal, dirt



Figure 2.1– The Microtech MSAR STG556. A 5.56x45mm NATO (.223 Remington) chambered bullpup rifle. 18.5 in. barrel, 26.5 in. overall length.

or sand, and even dense rubber or foam and usually have a maximum caliber limit.

Bullet Upset – The rapid expansion of soft lead bullets caused by chamber pressure and heat. A small amount of upset can be advantageous because it serves to seal the bore, creating good obturation and preventing gas cutting. Too much upset can strain and even crack a barrel.

Bullpup – A firearm configuration in which both the action and magazine are located behind the grip and trigger. Placing the firing controls further forward allows the action to double as the stock. This configuration allows the rifle to be much shorter without sacrificing barrel length. The bullpup is also much lighter than a rifle with the same barrel length. Its compact, lightweight design and balanced handling also help to mitigate some felt recoil, and reduce operator fatigue (Figure 2.1).

Bureau of Alcohol, Tobacco, Firearms, and Explosives (BATFE) – Formed in 1789 under the new constitution to collect taxes on imported spirits to offset the cost of the Revolutionary War. The BATFE is currently a division of the department of justice. The BATFE is responsible for the regulation, enforcement, and taxation of manufactured or imported alcohol, tobacco, firearms, and explosives.

Burn Rate – A term describing the measurement of the speed at which propellants deflagrates. Burn rate in propellant is rated from fast to slow. The burn rate in propellant is controlled by its composition, size, shape, and

deterrent coatings. Faster burning propellants are usually reserved for pistols, while slower powder is used for rifles.

Burst Mode – A firing system that enables the operator to fire a mechanically limited number of rounds with a single squeeze of the trigger, usually three. Burst limiters are used in an effort to conserve ammunition, while providing a degree of control over continuous automatic fire.

Buttplate – The hard plastic or metal cover on the end of the buttstock. Buttplates are used to protect the wood on the butt of a rifle or shotgun.

Buttstock – The rearmost portion of a rifle or shotgun stock that is stabilized and secured by the shoulder. Buttstocks can be integrated into a one-piece stock, or be a separate assembly that can be adjusted, or feature recoil absorbing materials or mechanisms.

Button Rifling – A type of rifling manufacturing process that is achieved by forcing a die through a predrilled barrel blank. The die features an outside profile the same shape of the intended rifling. The extreme pressure used to form the rifling also serves to work-harden and polish the bore.

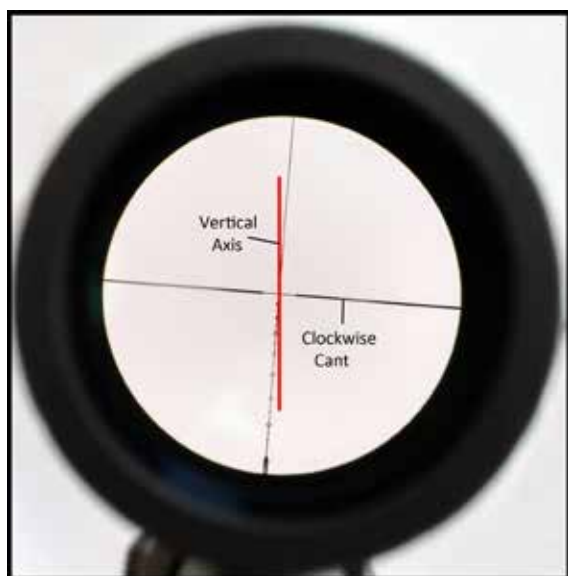


Figure 2.2– Even if the reticle is centered on your target, any cant will cause a shift from point of aim to point of impact.

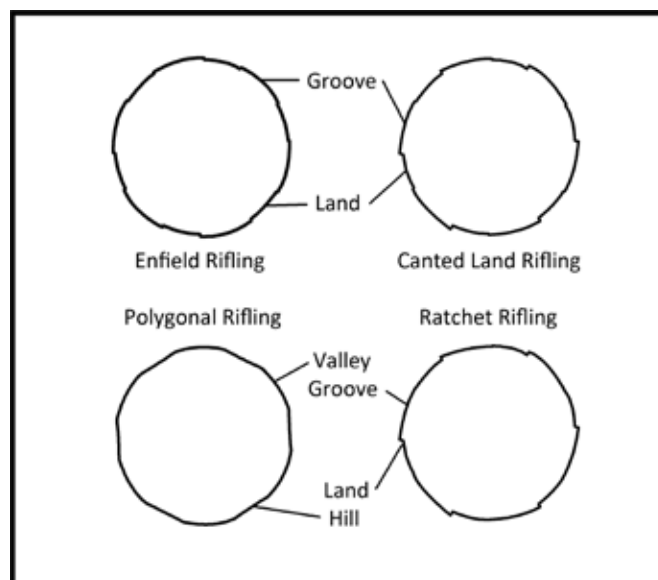


Figure 2.3– Reducing the amount of sharp corners inside of the bore will increase velocity and ease cleaning. The two types of canted land rifling on the right will perform better than the more conventional Enfield rifling on the left.



Figure 2.4–
Various types of rimfire, rifle,
shotgun and pistol cartridges
and their components.

1. A .22 Long Rifle rimfire cartridge and its components.
2. Various pistol cartridges and their components.
3. Various shotgun cartridges and their components.
4. Various rifle cartridges and their components.

C

Caliber/Calibre – 1. The diameter of the bore measured from land to land. In some cases it is measured from groove to groove. The measurement can be expressed in hundredths of an inch (.38, .40, and .45) or in millimeters (9mm, 10mm, 7.62mm). Caliber is also used to describe the outside diameter of a bullet. 2. A term used to describe a specific cartridge for which the firearm is chambered (.45 ACP, 5.56x45 NATO).

Cannelure – One or more grooves around the surface of a bullet or case. On bullets, cannelures provide space for lubricant, or crimping, or can be used to control expansion. On cases, they can be used to secure bullets from being pushed backward during feeding.

Cant – A deviation from center of a firearm's vertical axis. Canting a rifle while shooting can affect mid to long range accuracy when using sights or magnified optics. Some long-range shooters use a spirit level to help prevent cant. The higher the sights or scope sits above the bores axis the more prevalent the cant error will be. Typically, when viewed from behind the sights, a counterclockwise cant will produce a low left impact while a clockwise cant will produce hits low right (Figure 2.2).

Canted Land Rifling – A type of rifling that features a single bevel or multiple bevels on the lands. Removing the sharp corners of the lands reduces the amount of friction exerted on the projectile increasing velocity. The lack of hard corners reduces the amount of fouling, also making cleaning easier. Ratchet, 5C, and 5R are all types of canted land rifling (Figure 2.3).



Figure 2.5- Various types of cartridge cases. From left to right: .22 Long Rifle, 9x19mm, 9x19mm, .45 Long Colt, 7.62x39mm, .308 Winchester, .300 Winchester Magnum, 12 gauge.

Carbine – A term used to describe a light rifle with a barrel that is 16 in. or shorter. A carbine may also feature a folding or collapsible buttstock. A carbine is usually a shortened version of a rifle. For example: An M4 rifle has a 14.5 in. barrel with a collapsible buttstock and is the carbine version of the M16A1 rifle with a 20 in. barrel. The term carbine is also used to describe the armed forces M1 (semi-automatic) and M2 (select fire) rifles. The M1 is a short, light, limited-range rifle chambered in .30 carbine. The carbine concept is believed to be the brainchild of David Marshall “Carbine” Williams. He built his first prototype in the 1930s in a prison machine shop from scrap material and car parts. He holds two patents, one of which is for the short stroke piston-operating action used in the M1, and M2 carbines.

Carrier Tilt – A condition in piston-operated AR-15-style rifles, where the force of the piston pushing the bolt carrier rearward causes the rear to dive down into the receiver extension. Tilt can cause unneeded wear on the receiver extension and possibly malfunctions.

Cartridge – An assembled round of ammunition. A cartridge is comprised of a case, primer, propellant, and projectile (bullet, buckshot, shot, or slugs). Shotgun cartridges could also have a wad, cup, or sabot (Figure 2.4).



Figure 2.6- Various case heads from left to right: 9x19mm, 9x19mm, .45 ACP, .45 Long Colt, .223 Remington, 5.56x45mm NATO, 7.62x39mm, .308 Winchester, 12 gauge.

Case – The main component of a cartridge that houses all the other components. The case can be composed of paper, plastic, or metal. Pistol and rifle cases are sometimes referred to as brass. Shotgun cases are sometimes referred to as shells, or when empty, hulls (Figure 2.5).

Case Capacity – Refers to the available case volume measured in grains of water. Sometimes measured for practical capacity with a bullet seated.

Case Forming – The process of reshaping/sizing a case of one caliber for use as a different caliber. Case forming is usually accomplished with the use of a mechanical press and specialty dies. Case forming is very common in the world of wildcatting.

Case Head – The base of a case that contains the primer pocket and primer as well as the rim. Also, the area of a cartridge that is marked with caliber and manufacturing info (Figure 2.6).

Case Mouth – The opening at the top of a cartridge case that accepts, and secures the bullet. Some semi-automatic pistol cartridges such as the .45 ACP or 9x19mm headspace against the mouth.

Caseless Ammunition – A type of ammunition that does not use a case, but instead binds together the primer, propellant, and projectile into a single unit.

Casket Magazine – A box style magazine that stores cartridges stacked into four columns, rather than two (double stack magazine) or one (single stack magazine).

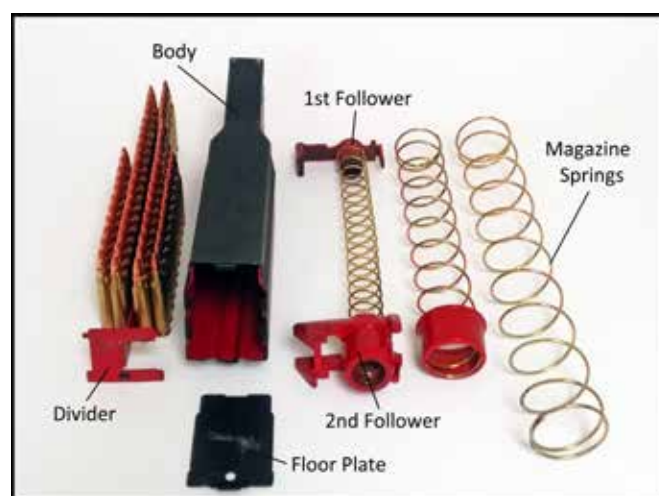


Figure 2.7- A 60 round casket style magazine. Rounds are arranged in a single double stack column before being split into two double stack columns. This magazine is manufactured by SureFire LLC.

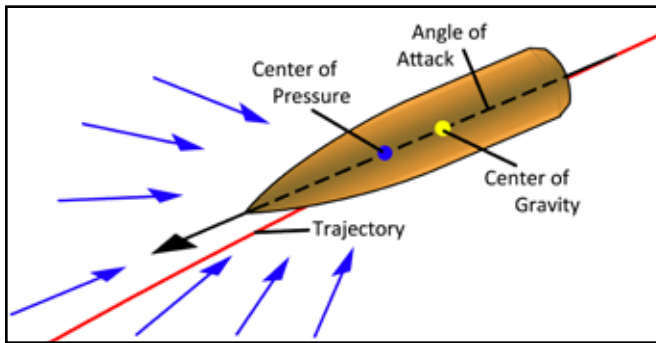


Figure 2.8- Any directional change in the flow of air around a projectile or change in the projectile's angle of attack will change its center of pressure. This change of center will cause the projectile to drift from its intended trajectory.

The four columns converge near the top of the magazine reducing their width to two columns, before preparation for feeding. Their purpose is to provide more capacity without the added size of extended high capacity magazines, or the added weight of drum magazines (Figure 2.7).

Centerfire – A type of reloadable ammunition that holds a centrally located primer in the case head. It differs from a rimfire cartridge because the primer mixture and anvil are housed in a removable cup rather than in the case rim.

Center of Form – The dimensional center of the bullet. The center of form is the bullet's longitudinal axis: the imaginary line from the center of its tip to the center of its base. While traveling through the barrel, the bullet will rotate around its center of form. If the bullet's center of form and center of mass are not perfectly aligned when it exits the muzzle, it will wobble or nutate slightly in flight.

Center of Mass – The point of a projectile where all of its weight is equally balanced around. Center of mass is the balancing point.

Center of Pressure (CP) – The average location of a sum of pressures against a projectile in flight. Air pressures will vary around the surface of the projectile as it accelerates, decelerates, or changes its angle of attack. These changes in center of pressure will create instabilities in the projectile that will change its trajectory (Figure 2.8).

Chamber – The inside portion of a barrel that has been profiled to accept cartridges. Revolvers usually have multiple chambers in their cylinders (Figure 2.9).

Chamber Pressure – Strain or force inside a firearm's chamber during discharge. After a cartridge's primer is struck and combustion begins, there can be as much

as 65,000 pounds of pressure inside the chamber. The pressure begins in the case, forcing its walls against the walls of the chamber and sealing it. The remaining pressure is used to force the bullet through the bore. Chamber pressure may be expressed in pounds per square inch (psi) or copper units of pressure (CUP). There are three methods of measuring chamber pressure: copper crusher, Piezo method, or with a strain gauge. The Sporting Arms and Ammunition Manufacturers Institute (SAAMI) regulates the maximum allowable chamber pressure for each cartridge, ensuring safe and reliable functioning.

Charging Handle – A device on a firearm, which, when operated, results in manual feeding or ejecting of cartridges. The charging handle is used to manually cycle the first round of a semi-automatic firearm, usually a rifle or shotgun.

Checkering – A gripping surface made from a pattern of diamond-shaped protrusions. Checkering is usually done by cutting crisscrossing diagonal lines with either a file or special machine cutters. Checkering can be cut in either wood or metal or molded into polymer parts (Figure 3.0).

Cheek Piece – A raised portion of the buttstock or an additional piece. The cheek piece is intended to support the cheek and provides a riser for better sight alignment with the line-of-sight of the eye.

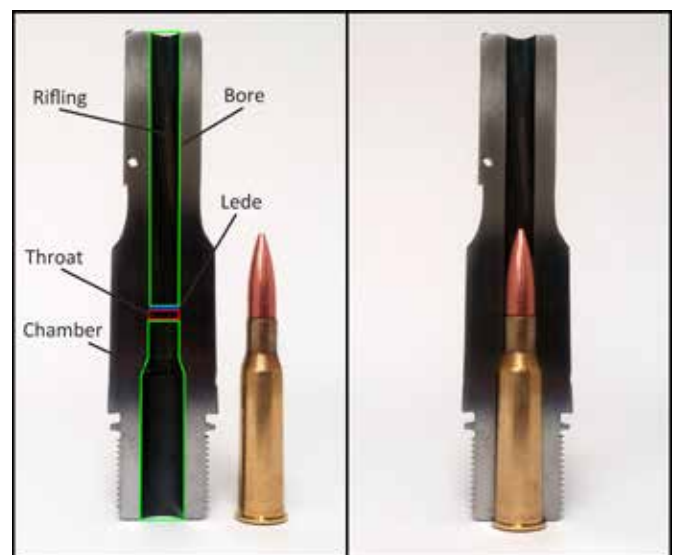


Figure 2.9- If a chamber is cut very precisely to the dimensions of a cartridge's dimensions it will align the bullet to the bore more concentrically and lead to greater accuracy. Too tight of a chamber will lead to suffering reliability in semi-automatic firearms.



Figure 3.0- Top: A very clean example of standard hand checkering with simple borders. Bottom: A fine example of exhibition-grade checkering with ornate borders.

Choke/Tubes – Used to constrict the muzzle of a shotgun to control the spread of shot. A choke tube can either be integrated into the barrel or screw in, as in the case of replaceable choke tubes.

Chronograph – An instrument used to measure the velocity of projectiles. Chronographs are used to help develop specific load data and to evaluate the consistencies of loaded ammunition. A chronograph works by using two light sensitive sensors. When a projectile passes the first sensor, a timer starts. Once the projectile passes the second sensor the timer will stop. The chronograph will use this time to calculate the projectile's speed. A chronograph will also keep records of multiple shots, and display statistics such as standard deviation and extreme spread.

Clay Bird (Pigeon) – A saucer-shaped disk composed of a clay-like material used in shotgun sporting events. Also called clay pigeons or clay targets.

Class III Firearm – Any firearm that is regulated under the National Firearms Act (NFA). Class III firearms include, but are not limited to, machine guns or firearms that can fire in bursts or automatic, short-barreled rifles or shotguns, Any Other Weapons (AOW), and silencers (suppressors).

Click – An increment of adjustment used for zeroing sights. Though there is no specified value to one click, it usually provides less than 1 in. of adjustment at 50 yd.

Clip – A device, case, or reservoir designed to hold cartridges intended to be easily loaded into magazines. The term clip is also used to misidentify box magazines.

Closed Bolt – A common classification for any type of action that is set to fire with a round in the chamber and the breech locked. The term closed bolt comes from the fact that the bolt and breech are closed at the beginning of the firing cycle, unlike open bolt-actions that begin the firing cycle with the bolt at the rear of its travel. There is significant reliability, accuracy, and precision advantages to the closed bolt-action. When the trigger is squeezed and the hammer or striker is released, there is a slight movement created before discharge that can shift point of aim. This slight movement is negligible compared to the significant movements of the open bolt design. Also, there is less chance of experiencing a failure to fire when using a closed bolt-action. The majority of all single shot and repeating firearms fire from a closed bolt.

Cock(ed) – The action of setting the firing mechanism into the firing position. When the hammer or firing pin are locked into the firing position. On early firearms the hammer was referred to as a cock (Figure 3.1).



Figure 3.1- Three different styles of hammers in three different positions, de-cocked, half cock and cocked.

Cocked and Locked – A term used to describe a firearm in its “ready” position with the safety activated. The term comes from the sequence in which repeating firearms are charged. First the action must be cycled to the rear, “cocking” the hammer or striker. When the action closes it chambers, a new cartridge and “locks” the breech. This term typically applies to semi-automatic pistols that are used for concealed carry.



Figure 3.2- The shape of the trigger guard and the inclusion of serrations provide a leverage point for the index finger to act upon.

Cocking Indicator – A small device used in some firearms to help identify that it is cocked. A cocking indicator may come in the form of a pin that protrudes from the rear of a firearm's action or slide, or knobs, or components that protrude from the firearm that wouldn't do so if the firearm was not cocked and chambered.

Collimator – A device used to narrow or align light waves so each ray runs parallel to the next. A collimator will convert light rays (waves) into beams (parallel lines) that are focused into infinity. Collimators are most commonly found on holographic or red dot sights. A light source such as a laser or light emitting diode (LED) is bounced off or through the collimator to illuminate or reflect a reticle image. Collimating light allows these sights to exhibit little to no parallax because the rays run parallel to the firearm and barrel and can be focused into infinity. A boresight also uses a collimator to help align sights.

Colonel Cooper, Jeff – Born May 10, 1920 as John Dean Cooper; “Jeff” Cooper is the father of the modern pistol shooting technique, and advocate for the “combat mindset.” A veteran of both WWII and the Korean War, Col. Cooper became the 20th century's foremost expert on the use and history of small arms. In 1976, Cooper formed the American Pistol Institute (now Gunsite Academy) to teach his pistol technique and rifle and shotgun courses to military, police, and civilians. On top of having his master's degree in history, and a bachelor's degree in political science, Col. Cooper was also an accomplished author and instructor. Cooper was also involved in the design and conception of several firearms including the 10mm auto Bren Ten pistol and the .308 scout rifle. Col. Jeff Cooper passed away on September 25, 2006 at the age of 86.

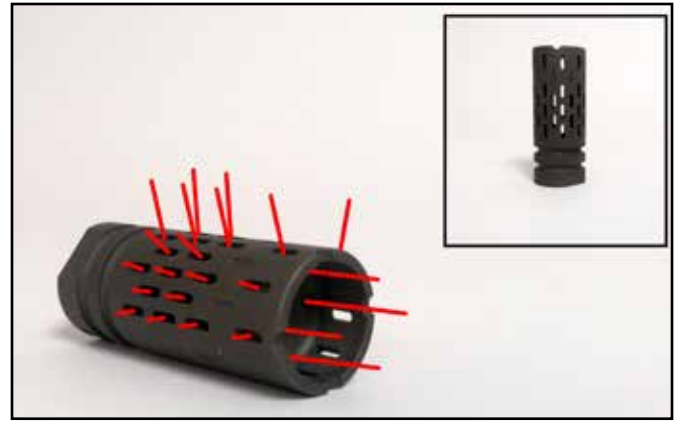


Figure 3.3- The compensator helps the firearm resist muzzle rise and twist by directing expanding gas in the opposite direction. The expanding gases create a thrust force that counters the rise and twist.

Comb – The upper portion of a buttstock that serves as a rest for the cheek as well as a consistent point of contact for sight alignment. The comb differs from a cheek piece because it is not usually raised, and the cheek piece generally sits on top of the comb.

Combat Guard – A trigger guard that is contoured for the support hand index finger. The combat guard is meant for a two-hand hold and utilizes the extra leverage provided by the trigger guard. Also known as a hooked trigger guard (Figure 3.2).

Combination Gun – A long gun that uses two barrels: one chambered for a shotgun cartridge, the other for a rifle cartridge. Most combination guns use an over/under configuration where the barrels are stacked vertically. Some are a side-by-side configuration where the two barrels sit beside each other.

Combustion – The act or process of burning. An exothermic chemical reaction that converts propellant into heat and gas. Combustion can be characterized by the speed at which it propagates or spreads. Burn rates that exceed the speed of sound are classified as detonation. A burn rate of a few meters per second is classified as deflagration. Slower burn rates can be classified as a smolder or slow burn.

Compensator – A device used to reduce the upward movement of the muzzle during recoil, also known as flip or rise. A compensator works by redirecting gas upward, creating thrust that will push the muzzle down (Figure 3.3).



Figure 3.4– A 9x19mm pistol and a 5.56x45mm rifle with their respective conversion units, allowing them to both fire the same .22 Long Rifle cartridge. Replacing the slide and magazine of the 9mm pistol and the bolt and magazine of the 5.56mm rifle with its respective conversion unit allows the operator to train with cheaper, lighter recoiling ammunition.

Components – The individual parts that comprise a cartridge, such as the case, primer, bullet and propellant.

Compressed Charge – An amount of propellant that is crushed by a seated bullet. Compressed charges are believed to be more accurate than non-compressed charges because the force of expanding gas against the bullet is less intense when the propellant is touching the base of the bullet, allowing the bullet to enter the rifling more uniformly. When reloading, it is important to know whether or not a certain cartridge or type of propellant is supposed to be compressed or not.

Cone – The tapered portion at the front of a shotgun chamber whose diameter decreases to bore diameter. Also the rear portion of a shotgun's choke that tapers to constrict the shot to form tighter patterns.

Conventional Rifling – A term to describe Enfield-type rifling. Conventional rifling typically consists of lands and grooves that spiral down the bore. Conventional rifling differs from canted land or polygonal rifling because the transitions from lands to grooves are typically very sharp near 90° angles.

Conversion Unit – Parts or assemblies that are used to convert a firearm of one caliber to another, usually smaller caliber. Conversion units are used to train with one firearm by replacing either the bolt or slide with a separate assembly that allows the use of cheaper, lower recoil rimfire ammunition (Figure 3.4).

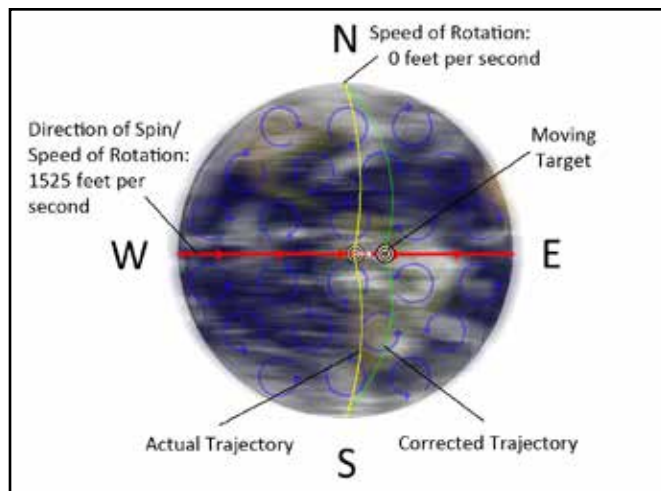


Figure 3.5– The earth will move away from a projectile in flight, causing a shift in point of impact. The drift will be at its greatest near the equator where the earth is rotating fastest.

Copper Jacketed – A term applied to bullets that use a pure copper envelope or bullets with a copper-alloy gilding metal jacket. Jackets are used to protect the bullet and bore from each other. The jacket protects the soft lead core of a bullet from deformation and abrasion from the rifling and severe pressure. The jacket protects the bore from lead deposits or other core materials such as steel spikes. The jacket also increases velocity as opposed to non-jacketed lead bullets.

Copper Units of Pressure (CUP) – A term used to describe a method of measuring chamber pressure. Measuring is accomplished by using a specially designed test chamber that has a small port in it. The port is plugged with a small piston. On top of the piston sits a small copper cylinder of a known length, mass, and density. Upon discharge, the chamber pressure forces the piston to crush the cylinder. The cylinder is measured, and the results are compared to others that were crushed by a known pressure.

Cordite – A low explosive propellant used mostly in Great Britain. It is a double-based smokeless firearm propellant comprised of nitroglycerine and guncotton (nitrocellulose) formed into long cordlike strands.

Core – The heart of a bullet. The core is usually composed of lead, but it may also contain a steel or alloy spike with armor-piercing bullets. The core may also be made of wood, steel, plastic, powdered metal or any other dense material. The core is sometimes fully or partially wrapped by a jacket.



Figure 3.6– A non-standard crosshair reticle. This reticle features hash marks and rings to compensate for bullet drop without adjusting the elevation turrets.

Coriolis Effect – Horizontal bullet drift caused by the rotation of the earth. Although the Coriolis Effect impacts all projectiles, it will not become prominent until beyond 1,000 yd. Even at that distance the drift may only be a couple of in. depending on velocity. The Coriolis Effect will impart a clockwise(right hand) force in the northern hemisphere causing the projectile to drift right, and a counterclockwise(left hand) force in the southern hemisphere. Also, because the earth is spinning faster near the equator, the forces will be greater there than near the poles (Figure 3.5).

Corrosion – The decay of metal from rust. Corrosion is caused by salt deposits left over from the burnt propellant and primer that attract moisture. Corrosion is produced when metal chemically reacts with an oxidizing agent such as oxygen, in the presence of water or moisture.

Cosmoline – A protective, rust-preventing grease used on ferrous metal parts, previously used by the armed services.

Creep – Excessive travel or movement of the sear before releasing the hammer or striker during trigger squeeze. Creep is also known as drag or crawl.

Crimp – The inward folding of the case mouth or tension used to secure a bullet in a cartridge. There are two main types of crimps: roll and taper. A roll crimp is literally a rolled section of the case mouth folded into the cannelure of the bullet. Roll crimps are used on lead

bullets in rimmed cases intended for revolvers. Taper crimps retain the bullet with tension rather than a flange. Taper crimps are used with cartridges that headspace against the mouth of the case. The fold at the top of shotshell that holds the shot is also referred to as a crimp.

Crimp Die – A reloading die that crimps the case mouth to the bullet or folds the top of a shotshell.

Crimped Primer – Used in military cartridges, the primer is secured to the primer pocket by a flange indented at the mouth of the primer pocket. The purpose of crimping the primer in place is to prevent a blown primer from sustained automatic fire.

Cross Bolt – A pin or bolt passing laterally through the stock of a rifle or shotgun behind the recoil lug. It is used to reinforce the stock and transfer recoil forces over a wider area.

Cross Eye Dominance – A condition where the dominant eye is on the opposite side of your dominant hand. This can cause problems while shooting long guns because mounting a rifle or shotgun on your strong hand side will make it difficult to align your opposite eye with the sights.

Crosshair – A variation of a reticle that uses very thin intersecting lines in the shape of a cross, used in magnified or telescopic sights (Figure 3.6).



Figure 3.7– Four different muzzle crowns. 1. Flat crown with beveled bore. 2. Round or "Hunters" crown. 3. 11 degree "Target" crown. 4. Hybrid flat and target crown with beveled edges.

Crown – The recessed portion of the barrels muzzle that protects the edge of the bore. The crown is the last part of the barrel to contact the projectile so its shape is used to smooth the transition of exiting gas. If the crown's shape was not concentric, exiting gases would not be distributed evenly around the projectile, causing a disruption in its flight (Figure 3.7).

Curios or Relics – Defined by the BATFE as that “*which are of special interest to collectors by reason of some quality other than is associated with firearms intended for sporting use or as offensive or defensive weapons.*” They must meet the following criteria:

- Must be manufactured 50 years prior to the current date
- Must be certified by the curator of a municipal, State, or Federal museum which exhibits firearms to be curios or relics of museum interest
- Is a novelty, rarity, bizarre, or has association to an historical event or person

Cut Rifling – A rifling manufacturing process that uses cutters or teeth to remove a small amount of material at a time. Single-point cut rifling or hook rifling uses a single cutting head to cut one groove at a time. Broach rifling uses a tool with multiple cutters to cut all the grooves in one pass. Cut rifling typically induces less stress on the barrel than button or hammer-forged rifling.

Cut Shell – An improvised slug. A cut shell is made by cutting perforations around a shotshell forward of the wad but below the shot cup. During discharge, the forward portion of the case separates, holding shot in the remaining portion of the case and drastically reducing dispersion. Cut shells should not be used in pump-action or semi-automatic shotguns because of the increased chance of a case head ripping off and creating a malfunction.

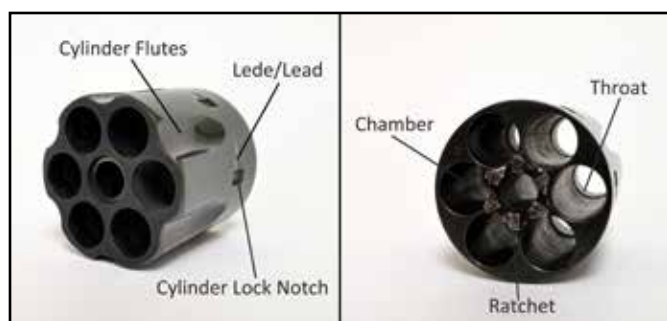


Figure 3.8- This single-action cylinder combines the functions of a partial chambered barrel and magazine, but has no provisions for an extractor/ejector like a double-action cylinder.

Cutts Compensator – A device used on single barrel shotguns that acts like an adjustable choke as well as a compensator. The cutts device usually comes with a selection of inserts intended to tune the choke portion of the compensator. There are perpendicular slots cut into the top of the compensator that are intended to redirect expanding gas upward to counteract rise.

Cyclic Rate – The speed at which automatic firearms will cycle and discharge rounds. Cyclic rate is usually expressed in rounds per minute. An AK-47 has a cyclic rate of about 600 rounds per minute while an M16 can fire around 750 rounds per minute.

Cylinder – A part of a revolver that is cylindrical in shape and rotates on an axis that is parallel to the barrel. The cylinder is a carrier that contains several chambers, and combines the functions of a partial barrel and feed system (Figure 3.8).

D

Damascus Barrel/Twist – An obsolete barrel manufacturing method that uses strips of metal that are forge-welded around a mandrel. Damascus barrels are not rated for the pressure generated by today's smokeless propellants and must be used with low pressure black powder loads.

Decap (Deprime) – To remove a spent primer from a fired case. A tool called a decapping pin is used to push out the old primer in preparation for a new one when reloading cartridges.

Deflagration – A term used to describe subsonic combustion that spreads through flame or spark at relatively low velocities, below 1,125 feet per second. Deflagration propagates through heat transfer: a burning kernel of propellant will heat the kernel next to it until the point of ignition. Deflagration differs from detonation, which is spread at supersonic speeds and creates a shock wave.

Dehorn – A process of smoothing out projections on a handgun intended to be carried concealed. Usually the dehorning process will include cutting the spur off of the hammer and rounding any sharp edges that may catch on clothing.

Delayed Blowback – A type of blowback action used for higher power cartridges that stalls the bolts opening until chamber pressures drop to a safe level and/or the bullet leaves the muzzle. There are various mechanisms used to delay or retard the movement of the bolt, such as levers, rollers, rings, toggles, gas, and even design geometry.

Die – Used in loading and reloading to form and reform cases, and bullets. Dies can also resize cases and seat bullets.

Direct Gas Impingement (DI) – A type of gas-operated action that routes gas from a fired cartridge to cycle the action. This is usually accomplished with a gas port and tube that uses gas pressure to directly force the bolt back. The simplicity of this system over a piston system means there are less operating parts and a reduced mass. The main disadvantage of this system is that hot gas is vented directly into the breach. Excessive heat and debris can create wear and malfunctions if not properly maintained. DI systems are most commonly found on AR-15/M16-style rifles.

Disconnect (Interrupter) – A mechanism in semi-automatic firearms that prevents discharging of more than one cartridge with a single trigger squeeze. During some point of the action cycling, the connection between the trigger and the sear is interrupted until the trigger is released into its reset position. Once reset, another trigger squeeze will result in one round being discharged.

Double-Action(DA) – A term used to describe the operating function of a trigger, usually in handguns. With a single squeeze of the trigger, it will set the hammer or striker to the cocked or firing position and release it to strike the firing pin and fire a round.

Double Barreled – A term to describe a firearm with two barrels.

Double Base Propellant – A firearm propellant used in modern day smokeless cartridges. Double base powder gets its name from the use of two main explosive components: nitrocellulose (guncotton) and nitroglycerine or other nitrated organic compound. Stabilizers and other additives are also used.

Double Stack Magazine – A box-style magazine that stores cartridges in two side- by-side vertical columns in a staggered arrangement. Depending on the application, a double stack magazine may or may not taper at the top, essentially creating a single stack magazine near the feed lips. Double stack magazines typically are not as reliable as single stack magazines because they are prone to jams near the taper at the top of the magazine. Double stack magazines that feature a taper into a single stack will support the top round with both feed lips, while straight-wall double stack magazines will support the top round with one lip (Figure 3.9).

Drag – The force upon a projectile from air resistance, causing it to decelerate. Drag will exert an opposing force on a projectile parallel to its longitudinal axis (tip to base) and its direction. Drag is dependent on the size and shape of the projectile, and is proportional to its velocity (Figure 4.0).

Drift – A projectile's horizontal deviation from its original trajectory. Drift can be caused by rotation, or wind. The Coriolis Effect may make a long-range projectile appear to drift but it is actually the earth moving under it. All contributing factors may lead to a horizontal deviation measured in feet at 1,000 yd. (Figure 4.1).



Figure 3.9- Pistol and rifle double stack magazines. Left: A 30 round double stack rifle magazine that feeds from each feed lip. Right: A 17 round double stack pistol magazine that feeds centrally from both feed lips.

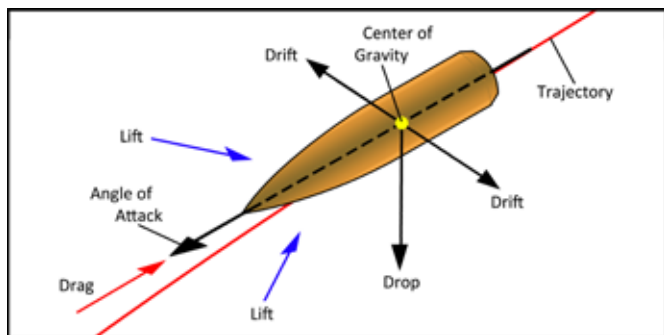


Figure 4.0-4.2- There are an array of forces acting upon a projectile during flight. Gravity, air pressure and wind will all force a projectile to deviate from its intended trajectory.

Drop – A projectile's descent from the force of gravity. The projectile will immediately begin to drop once it leaves the barrel and will never rise above the bores axis. The longer a projectile takes to reach its target, the more time gravity will have to affect it. High-velocity projectiles will experience less drop than slower projectiles at the same distance. This is why faster moving projectiles are said to have “flatter” trajectories. Bullet drop can be compensated for by using a higher point of aim for targets farther away. Drop can be affected by the Eotvos and Magnus Effects as well as shooting at vertical angles (Figure 4.2).

Drum Magazine – A type of magazine that is cylindrical in shape like a drum. Unlike box magazines that store rounds in columns, a drum magazine's rounds are stored in a spiral configuration around the center of the magazine. Drum magazines are usually very high capacity 50–100+ rounds. The design of a drum magazine can make it significantly heavier than a casket magazine of the same capacity.

Dry Fire – A term used to describe the firing pin or striker impacting an empty chamber. Dry firing can be hazardous to some firing pins/strikers due to the lack of a buffer (brass primer) to slow its impact on the breech face or other breech parts. Dry fire also refers to a type of practice that helps build trigger control with the use of snap caps that allow dry firing without worry of damage.

Dummy – A type of inert cartridge that uses a case, bullet, and an uncharged primer, and zero propellant. Dummy rounds are used for testing feeding, extraction, and ejection in firearms.

Dwell Time – 1. In non-gas-operated actions it is the time from which the bullet leaves the case mouth and enters the bore, until it leaves the muzzle. 2. The time that a gas-operated action stays pressurized, initiating

cycling. Dwell is from the time the bullet passes the gas port, until it leaves the muzzle. Longer dwell time will give the case more time to contract and let chamber pressures drop, providing better extraction.

E

Eject – The action of forcing a case from the breech of a firearm. After discharge the case is extracted from the chamber and ejected through the ejection port.

Ejection Port – The opening in the receiver where fired cases are expelled from. Most repeating firearms will feature an ejection port (Figure 4.3).

Ejector – The part(s) of an action that force a fired cartridge case from the firearm. Extractors only serve to pull the case from the chamber so the ejector must expel the case from the breech in preparation for feeding. The use of a spring-loaded finger or a protrusion mounted to the receiver is the most common means of ejection. The spring-loaded finger is usually incorporated into the bolt face and pushes the case out of the ejection port. The protrusion or arm that is mounted to the receiver is stationary and is dependent on the action cycling to the rear and the extractor driving the case into the arm and forcing it out of the ejection port.



Figure 4.3- Various ejection ports on different firearms. Clockwise from top left: A semi-automatic rifle, a pump-action shotgun, a bolt-action rifle and a semi-automatic pistol.



Figure 4.4- Different styles of engraving, from filigree patterns to scenery.

Ejector Rod – A part on some revolvers used to push cases from the chambers of the cylinder. The ejector rod is typically a spring-loaded plunger with a head shaped to fit around the rims of the cases. When depressed, the ejector rod will simultaneously extract and eject the spent cases.

Electronic Firing – The use of electronic current to fire a cartridge instead of ignition coming from striking a primer.

Elevation – 1. The angle of the bores axis along its vertical plane. Elevation represents the muzzles location up and down. 2. The vertical adjustment of a firearm's sights to compensate for high or low point of impact.

Energy – The ability to perform work. A projectile's energy is a product of mass and velocity squared, expressed in foot pounds (ft.-lb.) at a given range. See also *Bullet Energy*.

Energy Transfer (Dump) – The ability of a projectile to effectively displace its energy into a target. Energy transfer is dependent on many factors: projectile size, weight, and design as well as velocity and target composition. If a projectile were to perforate the target completely and continue to travel, all of its energy would not transfer to the target. Energy transfer alone is not the only factor in creating an incapacitating injury or fatal wound. Shot location, tissue disruption, penetration and or perforation must all be considered.

Enfield Rifling – A type of rifling that uses very sharp, almost square, lands and grooves. The term Enfield rifling typically denotes the rifling profile rather than a specific rifling pattern. Enfield rifling uses two to six grooves of varying widths, depths and twist rates.

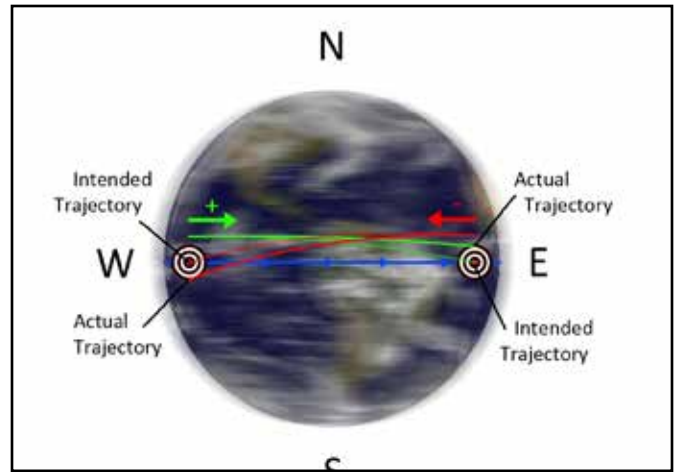


Figure 4.5- Shooting in the direction of the earth's rotation will seemingly increase the projectile's velocity, while shooting against the earth's rotation decreases it.

Engine Turning – See *Jeweling*.

Engraving – The art of hand-cutting images or patterns in metal or other hard surfaces. Engraving is used to personalize or embellish (Figure 4.4).

Eotvos Effect – The perceived change in gravitational forces when shooting east or west. The Eotvos Effect will influence the drop of the projectile depending on which direction you shoot. The earth rotates around its axis at about 1,500 feet per second to the east. When a projectile is fired to the east, its velocity will magnify because of the earth's rotation. The increased velocity will create a centrifugal force that pushes the projectile away from the earth's center of mass, seemingly defying gravity. Shooting east will result in a higher point of impact. Shooting to the west will have the opposite effect (Figure 4.5).

Exit Pupil – In magnified optics it is the virtual aperture of the eyepiece lens. The exit pupil is the focal point at which the optic transmits its image and light to the operator's eye (Figure 4.6).

Exothermic Reaction – A chemical reaction that produces energy in the form of light or heat. Combustion is an example of an exothermic reaction. When propellant burns, it produces hot, rapidly expanding gas and muzzle flash.

Expander – Part of a reloading die that widens the case mouth to accept a bullet.

Expanding Bullet – A projectile designed to expand on impact. The projectile will increase its diameter to limit penetration and transfer more energy to the target. Typical designs are the hollow point bullet and the soft-point bullet.

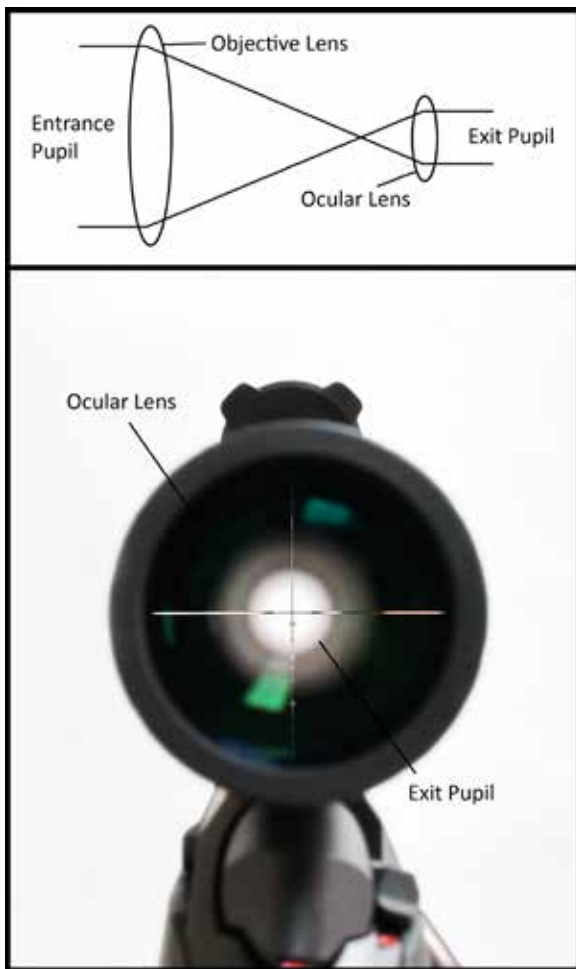


Figure 4.6- The larger the exit pupil is, the more light it will transmit to the shooter allowing for a bright, sharp target image. A large exit pupil will also provide a brighter sight picture in low light situations.

Expansion Ratio – The ratio of bore volume (base of seated bullet to muzzle) to case capacity. It is the measurement of the volume of gas compared to the volume of propellant. A higher ratio (12:1) will have more bore volume, allowing the gas volume to multiply many more times than a lower ratio (5:1). Higher ratios will generally lead to higher velocities. Expansion ratio is dependent on case capacity as well as bore diameter and barrel length. With all other factors being equal, a longer barrel will have a higher expansion ratio because of its increased bore volume.

External Ballistics – A part of the science of ballistics that deals with behavior of a projectile in flight. It involves such factors as drag, drift, and drop. Also known as exterior ballistics.

Extract – The action of removing a case from the chamber.



Figure 4.7- The extractor “extracts” the fired case from the chamber in preparation for feeding and firing a new cartridge.

Extractor – A hook or claw-like part that grasps the rim of a case and removes it from the chamber. The extractor will remove the case so that the ejector can push it out of the ejection port (Figure 4.7).

Extreme Spread – 1. A measurement used to determine the maximum distance groups of shots disperse. The smaller the spread the higher the rate of precision is produced by the firearm or ammunition or combination of the two. There are two ways to measure extreme spread: extreme spread center-to-center (ESCC), and extreme spread edge-to-edge (ESEE). To figure out ESEE, measure from the two furthest outside edges of the group. To figure out ESCC, subtract the diameter of the bullet from ESEE. Extreme spread is not the most precise way to measure a group as it only uses two points of data, but it can be used to provide a good idea of performance. 2. A measurement of the greatest deviations of velocity for a given load. Extreme spread is calculated by subtracting the lowest velocity from the highest, for example: extreme spread for 2,500 fps, and 2,550 fps would be 50 fps.

Extruded Powder (Tubular) – A type of smokeless propellant that is shaped like small rods. Extruded powders are usually single based and burn slow to medium slow. Burn rate is controlled by the diameter and length of the rods as well as deterrent additives. Extruded powder is most commonly found in rifle cartridges.

Eye Dominance – The natural tendency for one eye to take precedence over the other. Usually your dominant eye is on the same side of your strong hand and therefore will line up with the sights when a long gun is mounted. There is a condition where your dominant eye is opposite of your strong hand side, which is known as cross-eye dominance.

Eye Relief – The optimal distance an operator must hold his eye from a magnified optics ocular lens to obtain a correct sight picture and the greatest field of view. Eye relief plays an important role when using a scope on a high power rifle. If there is not enough relief, there is a chance the eyepiece may strike the operator around the eye during recoil (Figure 4.8).



Figure 4.8- Most modern day optics feature eye relief between 3.5-6 in. Anything shorter would be dangerous under recoil on a high power firearm. Some "scout" style scopes may have 10+ in. of eye relief to accommodate the scope being mounted further forward.

F

Falling Block Action – A type of single-shot action where the breechblock travels vertically in the receiver. The breechblock is raised and lowered by of a finger lever. Sharps and Win.ter single-shot rifles use a falling block action.

Fanning – A method of rapidly firing a single-action revolver. Fanning is accomplished by holding the trigger back and rapidly cocking and releasing the hammer. Because the trigger is depressed, the hammer will fall and discharge a round. Fanning can damage a revolver, so it should be discouraged.

Federal Firearms License (FFL) – A license issued by the BATFE that allows the commercial sale, manufacturing, and importation and exportation of firearms. An FFL is required by anyone who is selling, fixing and repairing, or customizing firearms.

Feed Lips – The upper edges of a magazine that align the cartridge in preparation for feeding (Figure 4.9).

Feed Ramp – A portion of the barrel or frame that guides the cartridge into the chamber. Feed ramps are most commonly found on magazine-fed semi – automatic firearms. A malfunction may occur due to an accumulation of debris on the ramp. The debris can cause the cartridge to hang up or change its alignment. A roughly machined feed ramp may also lead to a jam.

Feeding – The act of delivering a cartridge from storage (magazine) to the chamber in preparation for firing. Feeding may be accomplished manually by operating the bolt of a bolt-action, or automatically in a semi-automatic firearm.



Figure 4.9- The dimension and shape of the feed lips are critical to proper function in repeating firearms. Bent or damaged feed lips can lead to feeding issues.

Feet Per Second (FPS) – A unit of speed and velocity that expresses the amount of feet that are travelled in one second.

Felt Recoil – The perceived force felt by the operator during recoil. Felt recoil differs from actual recoil in the respect that it will affect each operator differently. The amount of recoil that the operator feels is dependent on many factors, including operator's size, strength, grip and ability, the weight of the firearm, its action, and caliber. Differences in specific loads of ammunition can also play a huge role in felt recoil. Variations in the size of the powder charge, bullet weight, and muzzle velocity will affect recoil velocity and recoil energy. The addition of rubber grips and butt pads, recoil buffers, and other recoil-dampening devices are used to cushion the effects of recoil and minimize felt recoil.

Field of View – In magnified optics it is the maximum area viewed through the scope, usually measured in feet at a distance of 100 yd. The field of view through a scope with adjustable magnification will decrease as the zoom increases. For example, a typical 3–9X variable scope will have a field of view of about 30 ft. at 3X and a field of view of about 14 ft. at 9X.

Firearm – A portable gun. A firearm is meant to be operated by one person. Handguns, rifles, and shotguns are all classified as firearms. The earliest known firearms were discovered in china in the 13th century. Firearms are sometimes referred to as small arms (Figure 5.0).

Fire Control Group (FCG) – The part of a firearm responsible for creating ignition of a cartridge. The fire control group usually consists of a trigger or striker, a hammer, sear, disconnector, and a safety. In the case of a select fire firearm, it may have more than one sear.

Fire Forming – The shaping of a case to fit the chamber. Fire forming is accomplished by firing a cartridge in a specific chamber. Upon discharge the case will expand to fit the dimensions of the chamber, and then shrink slightly to aid in extraction. The increased case dimension allows less play in the cartridge to chamber fit. Fire forming may also be used to resize or reshape cases for use in wildcatting.

Firing Pin – Part of the action that strikes the primer to ignite the propellant and fire a cartridge. The firing pin may be actuated by springs or by contact with the hammer (Figure 5.1).

Fixed Magazine – An internal magazine that cannot be readily removed from the firearm without tools or disassembly. To load a fixed magazine the action is opened and cartridges are pressed into the magazine either by hand or by stripper clips.

Flake Powder – A chip or disk-type smokeless propellant that usually burns quickly. The burn rate of flake powder is typically faster because of the reduced size and surface area. The small disks ignite faster and burn more evenly. Flake powder is usually double-based. Flake powder is used in pistol and shotgun cartridges.



Figure 5.0– Different types of firearms and actions in various calibers. Clockwise from top: A gas-operated, semi-automatic carbine chambered in 5.56x45 NATO. A short recoil operated, semi-automatic, double stack, striker fired polymer pistol chambered in 9x19mm. A pump-action youth shotgun chambered in 20 gauge. A single-action solid frame revolver chambered in .45 Long Colt. A short recoil operated, semi-automatic, single stack, hammer fired pistol chambered in .45 ACP. A Mauser style bolt-action rifle chambered in .300 Winchester Magnum.



Figure 5.1- Different types of firing pins. Left: A spring-loaded firing pin. The spring is used to hold the firing pin below the bolt face and prevent an unintentional primer ignition. Right: A free-floating firing pin. Its lack of mass does not produce enough energy to ignite the primer.

Flash Hider – A device that is attached to the muzzle of a firearm that reduces visible flare. The flash hider works by rapidly cooling burning propellant and gas as they exit the muzzle. Flash hiders were designed for use with shorter barrels because there is more scorching propellant escaping the muzzle. With longer barrels the deflagration process is complete before reaching the muzzle, so there is little to no visible flash. There are two common types of flash suppressors: birdcage and duckbill. The duckbill uses prongs that extend from the muzzle that allow gas to escape sideways. The birdcage is basically a duck bill with a protective ring around its outermost edge. Also known as a flash suppressor (Figure 5.2).

Flash Hole – A hole in the base of a cartridge case that transfers the flash of an ignited primer to the propellant charge.

Floating Barrel – A barrel that is only supported along 3 in.–5 in. of its chamber end so that its natural oscillation frequencies maintain consistency. Floating a barrel removes unwanted stress and pressure from the forend or operator that may change point of impact, ruining



Figure 5.2- The shape of the ports on the birdcage flash hider allow escaping gases to rapidly expand and cool, reducing the amount of flash seen from the muzzle.

accuracy and precision. Floating a barrel contributes to better barrel harmonics.

Floating Chamber – A small device that converts larger caliber firearms to shoot the much smaller .22 LR cartridge. The floating chamber device sits inside the chamber of the larger firearm and magnifies the .22 LR's energy and uses it to cycle the action. The floating chamber performs like a hybrid blowback/piston-operated action when a cartridge is fired the device and case recoil rearward like a blowback action. When the device contacts the action, it acts like a piston and forces it rearward. The floating chamber is the second patent of the famous David Marshall "Carbine" Williams, who is considered to be the father of the carbine.

Floorplate – The metal plate used to cap the bottom of a magazine. Rifles that use a fixed magazine use either a fixed or hinged floorplate. Box magazines will use either a fixed or removable floorplate.

Fluted Chamber – Grooves or channels cut longitudinally around the circumference of a chamber. During firing the case will fire form to the chamber and hold longer until pressure drops before extraction. A fluted chamber is used to increase the dwell time of some automatic and semi-automatic rifles.

Fluting – Channels cut into metal for the purpose of removing weight (Figure 5.3).

Folding Stock – A long gun buttstock that is hinged so that it may be folded to make the firearm more compact.

Follower – The platforms on which cartridges ride inside of a magazine. The follower is powered by the magazine spring and forces the cartridges upward for feeding.



Figure 5.3- Fluting is usually found on medium-heavy contour barrels to help reduce weight. Fluting also leads to faster cooling because of the increased surface area and can even improve a barrel's harmonics through its design.

Foot-Pound Force (ft-lbf) – A unit of work or energy. It is equal to the force needed to move one pound a distance of one foot. A bullet energy of 1,290 ft-lb. is equal to the force required to move an object 1,290 pounds a distance of 1 ft., in theory under perfect conditions. In real life, energy transfer is dependent on many factors, with perforation being the most likely scenario depending on bullet design.

Forcing Cone – 1. In shotguns it is the area just ahead of the chamber that tapers to the diameter of the bore. The forcing cone restricts the shot charge, reducing the overall diameter of the pattern. 2. In revolvers it is funnel-shaped cone at the rear of the barrel that guides the bullet from the chamber to the rifling.

Forend – The portion of stock toward the muzzle end of a long gun that provides a gripping area for the support hand.

Forward Assist – A button commonly found on M16/AR-15-style rifles that is used to push the bolt and carrier into battery (Figure 5.4).

Fouling – An accumulation of debris. Fouling may consist of carbon and propellant build-up, lead and copper, or lubrication residue.

Fouling Shot – One or more shots fired through a freshly cleaned bore in order to break it in. There is a slight change in point of impact from a clean barrel to a slightly fouled barrel.



Figure 5.4– A finger attached to the end of the forward assist engages the notches in the bolt carrier. During cycling the bolt may not go fully into battery so the forward assist must be used to push the bolt and carrier forward, locking the breech.

Frangible – A bullet that is designed to disintegrate on impact to minimize penetration. Frangible bullets are often comprised of compressed metal powder like copper and tin or other materials. Frangible bullets are used in CQB training because they do not ricochet and are found on “green” ranges where you cannot use lead bullets.

Freebore – The distance a bullet travels through the throat from the chamber before it contacts the lede of the rifling (Figure 5.5).

Frequency – The number of wave oscillation cycles over a given time. A high frequency will have more oscillations in a given time than a low frequency. One oscillation cycle of the frequency is called the period. If an object was to oscillate 120 times a minute, its period would be .5 seconds or half a second between occurrences. Frequency is expressed in hertz and can be calculated by

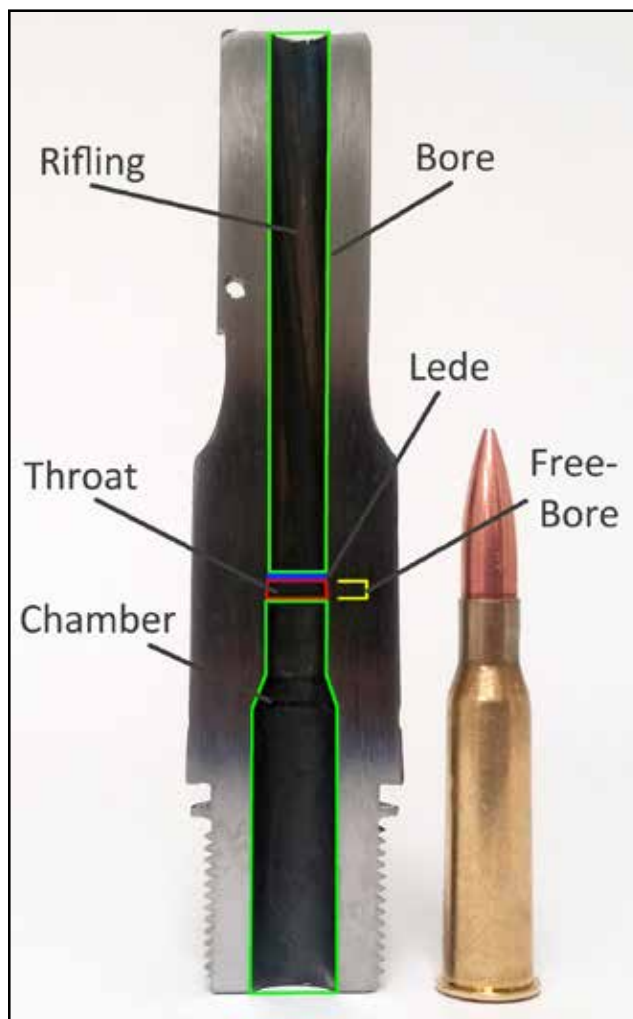


Figure 5.5– The amount of freebore in the chamber is critical to a firearm's safe function and precision. Too little freebore and you may experience dangerous pressure spikes, too much and the bullet has ample room to misalign before contacting the lede and rifling.

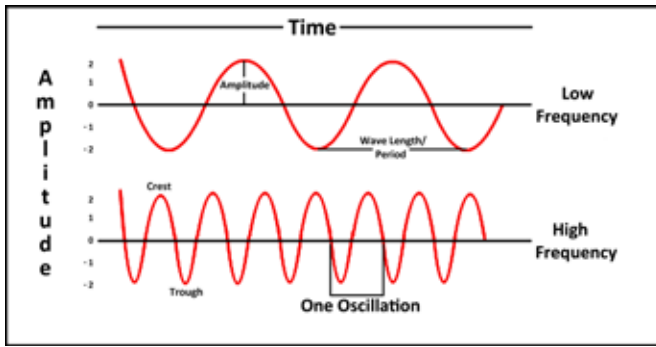


Figure 5.6– When a cartridge is discharged, a barrel may experience both high and low frequency vibrations. These vibrations will travel the length of the barrel and back as well as bounce off of each other. A stiff barrel will resist transmitting these waves into movement and decrease the chance of shifting point of impact.

dividing the number of occurrences by the time of the occurrences. For example, those 120 oscillations in 60 seconds would have a frequency of $120/60 = 2$ hertz

The frequency of the events can change the amplitude of the waves. This is known as resonance (Figure 5.6).

Front Strap – The front portion of a handgun's grip (Figure 5.7).

Full Charge – Any cartridge loaded to maximum SAAMI specifications.

Full-Metal Jacket (FMJ) – A bullet whose envelope wraps around the entire surface except its base. FMJ's will not expand and will typically perforate many materials without deforming.



Figure 5.7– The addition of texture and finger grooves to this front strap makes controlling recoil easier and adds a degree of ergonomics to the pistol.

Functioning Cycle (Cycling) – The loop of operations experienced by most repeating firearms. Starting with a cartridge in the chamber, the breech locked and the hammer cocked, the loop starts with: 1. firing; 2. unlocking; 3. extraction; 4. ejection; 5. cocking; 6. feeding; 7. chambering; 8. locking.

Once the breech is locked, the sequence can start again. Most lever, bolt, pump, automatic, and semi-automatic firearms employ this cycle for proper function.

A revolver's functioning cycle starts by loading each individual chamber of the cylinder. Once the cylinder or loading gate is closed, the handgun is loaded with a cartridge in the chamber. On a single-action revolver the hammer must first be cocked. Cocking the hammer also rotates the cylinder, aligning and locking the next chamber. Squeezing the trigger fires the round. The hammer must be re-cocked to fire again.

On a double-action revolver, squeezing the trigger will simultaneously rotate and lock the cylinder, cock the hammer, and fire a cartridge. The trigger is repeatedly squeezed until all rounds have been fired. A double-action revolver can also be fired in single-action by cocking the hammer. Once all rounds have been fired, the cylinder or loading gate must be opened and the cartridges are manually ejected, clearing the chambers for loading.

Funneling – Beveling and shaping the opening of the magazine well to aid in faster magazine changes. Removing any burrs or hard edges will prevent the magazine from hanging up.

G

Gain Twist Rifling – A type of rifling that uses a slower twist rate at the breech end of the barrel, which progressively gets faster toward the muzzle. Gain twist rifling is used to extend the life of a barrel. By eliminating the stress that is imparted on the bullet and barrel as it enters the first few inches of the bore, the amount of erosion and wear is reduced, thus extending barrel life.

Game Gun – A term used to describe a firearm that has been modified for competition, enabling the operator to shoot faster and more precisely with reduced recoil.

Gas Check – A cup that is used on the bottom of some lead bullets that protects them from hot gas and pressure. Gas checks can be made of aluminum, brass, copper, or zinc. The gas check is swaged onto the bottom of the bullet covering all or nearly its entire base. Gas checks are used in high pressure loads that use lead bullets. The soft lead alone is not enough to prevent gas cutting so a check must be used.

Gas Cutting – A condition where gas pressure jumps ahead of the bullet in the throat before it enters the bore. Excessive gas cutting combined with the pressure pushing from the rear can badly distort lead non-jacketed bullets from compression inside the bore.

Gas-Operated – A type of action (automatic or semi-automatic) that uses gas pressure directed from a port in the bore to cycle the firearm. This can be accomplished in various ways through the use of gas tubes, cups, and pistons. See also *Direct Gas Impingement*.

Gas Port – A small hole in a firearm's barrel that directs gas from the bore to use to cycle the action.

Gauge – The measurement of the diameter of a smoothbore shotgun's bore. The measurement represents the number of bore-sized balls that could be made from one pound of lead. For example, a 12-gauge would produce 12 balls, .729 in. in diameter, weighing $\frac{1}{12}$ lb. each.

Ghost Ring Sight – A type of peep sight. A ghost ring sight uses a rear aperture with a fairly large opening and a thin frame. When focusing on the front sight, the rear aperture will seemingly fade out of focus. Ghost ring sights are known for their fast target acquisition and moderate accuracy at close to medium ranges.

Glass Bedding – A process of strengthening a rifle or shotgun stock while also providing a tighter fit to the action. The use of epoxy resin with fiberglass or other reinforcement provides a very strong, very tight fit, eliminating accuracy- and precision-robbing play.

GO/NO-GO Gauges – Standardized precision measuring devices used to check headspace. A Go gauge represents allowable cartridge dimension, and No-Go represents larger than the allowable maximum. A breech or bolt should lock with a Go gauge in the chamber, and not lock on a No-Go gauge.

Grain – A unit of measurement of mass. In firearms it is used to measure propellant and bullets. There are 15.43 grains to 1 gram or 7,000 grains to one pound.

Granules – Individual fragments of propellant. Also known as kernels.

Greenhill Formula – An equation used to calculate the approximate twist rate for a given bullet. The formula was developed in 1879 by George Greenhill, a professor of mathematics. All that is needed to calculate twist rate (t) is the bullet's diameter (d), and length (l) in inches and its expected velocity.

For velocities slower than 1,500 fps, use this formula:

$$125(\text{constant}) \times (d)^2 / l = \text{twist rate}$$

For velocities between 1,500 and 2,800, use this formula:

$$150(\text{constant}) \times (d)^2 / l = \text{twist rate}$$

For velocities faster than 2,800 fps, use this formula:

$$180(\text{constant}) \times (d)^2 / l = \text{twist rate}$$

For example, a .224 diameter bullet .905 in. long traveling at 3,100 fps would need a twist rate of

$$180 \times (.224(d) \times .224(d)) / .905(l) = 9.98$$

or 1 turn in 10 in. (1:10).

If you already know the twist rate of your specific barrel and you want to know the longest bullet it will stabilize, you can modify the formula as follows:

$$125 \times (d)^2 / t = \text{length}$$

$$150 \times (d)^2 / t = \text{length}$$

$$180 \times (d)^2 / t = \text{length}$$

For example:

$$180(\text{constant}) \times (.224(d) \times .224(d)) / 10 = .903 \text{ in.}$$

A 1:10 twist barrel will stabilize a .224 diameter, .903 in. long bullet at over 2,800 fps.

Grip – 1. The portion of a long gun stock that is gripped by the trigger hand. 2. The handle of a handgun.

Grip Safety – A mechanical safety that protrudes from the rear of the grip. The grip safety prevents firing from unintentional trigger movement when the operator's hand is not on the grip.

Groove Diameter – The measurement of the diameter in rifled bores from groove to groove (Figure 5.8).

Grooves – Spiral channels in the bore of a barrel that induce rotation on the bullet in order to stabilize it during flight. See also *Rifling*.

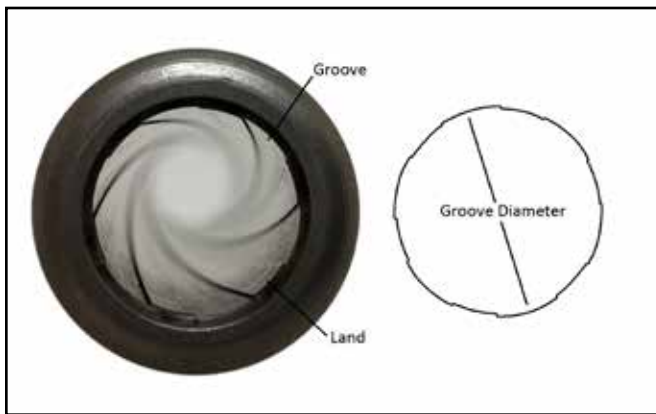


Figure 5.8– Typically in the United States groove diameter is used to denote caliber. For example, a .308 caliber barrel will have a groove diameter of .308. In other places land to land diameter is used to denote caliber.

Group – A term used to describe the pattern of multiple shots at a single point of aim. A group is used to determine firearm or ammunition accuracy and precision.

Gun – A tubular arm that is used to launch projectiles. A gun uses pressurized gas or other means to push a projectile through its barrel. The projectile may be solid, liquid, gas, or energy. The term gun may denote many types of machines or devices that range from artillery, cannons, or tank guns, to BB, potato, or water guns. When describing handguns, long guns, or machine guns, the term firearm is used. The word gun is more closely associated with cannons and other artillery. The first guns were made of bamboo and used black powder to fire spears or other projectiles. These first guns appeared in China over 1,000 years ago.

Gun Control Act of 1968(GCA) – A federal law signed by President Lyndon Johnson. The GCA governs the sale, purchase, and shipment (intrastate and interstate) of firearms, ammunition, and destructive devices. It focuses on prohibiting the interstate transfer of firearms except by licensed manufacturers or dealers and prohibits transfer to persons who are ineligible because of mental or criminal reasons.

Gunstock – The part of a long gun that contains the action and barrel and is used to secure and stabilize. It is usually made from some type of hardwood, but can be made from polymer, composites, or in the case of some long range competition guns, aluminum. The stock features a forend, grip area, comb, and butt.

Guncotton (Nitrocellulose) – A compound that is formed when plant matter is combined with nitrogen. Cotton has a cellulose content of about 90 percent

and when nitrated it produces a powerful explosive and propellant. Modern day single-base powders are nitrocellulose-based.

Gunpowder – The propellant used in muzzleloading firearms. The term should be used in reference to black powder because modern firearms use smokeless powder.

Gyroscopic Drift (Spin Drift) – A horizontal deviation in a projectile's trajectory caused by its rotational momentum. A projectile spinning around its longitudinal axis (tip to base) will not deviate in the direction its axis is pointing unless it is acted upon by an outside force creating nutation or precession. When a force is applied it will move perpendicular to the force in the direction of its rotation. Gravity is continuously applying a downward force from the moment the projectile leaves the muzzle. The projectile reacts by pointing its axis in the direction of its rotation inducing yaw. A projectile rotating clockwise will yaw to the right, while a counterclockwise rotation will yaw to the left. In respect to its trajectory the projectile axis will point slightly upward. Since there is no longer a drag component acting parallel to the projectile axis, a lift component is introduced. The projectile will roll or skid across the high pressure air it has deflected. The amount of drift is dependent on projectile length, the speed of rotation, time of flight and atmospheric conditions. The amount of drift may range from 3 in. to 3 ft. at 1,000 yd. depending on contributing factors (Figure 5.9).

Gyroscopic Stabilization – A condition that occurs with rotating objects where its rotational axis will not deviate from the direction it is pointing. Also known as moment of inertia.

H

Half Cock – A position used on some hammers that holds it away from the firing pin. It can also function to release the cylinder of some single-action revolvers for loading and unloading.

Half Jacket – A type of handgun bullet that uses a copper jacket along its bearing surface and base. The nose remains uncovered and is usually a hollow point design used to expand.

Hammer – The part of a firearm that is powered by a spring and pivots to strike the firing pin and ignite the primer. Some hammers have the firing pin integrated into them (Figure 6.0).

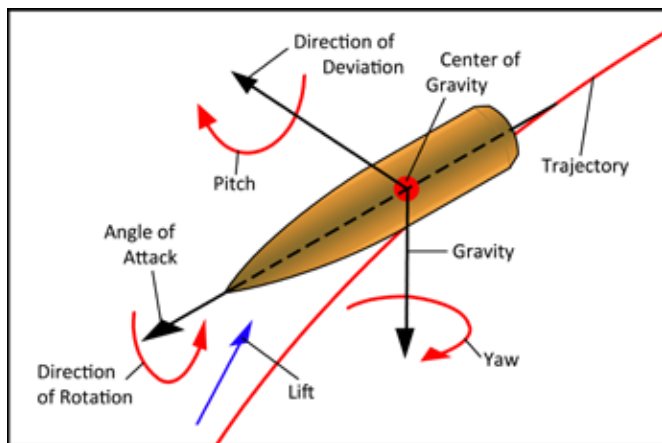


Figure 5.9- A spinning projectile already has a handful of forces acting upon it even before the introduction of wind. The additional force component disrupts the projectile so severely that it can alter its trajectory several feet at 1,000 yd.

Hammer Bite – A condition where the hammer pinches the web of the hand between itself and grip or frame.

Hammer Block – A device that will intercept the hammer and prevent it from striking the firing pin unless the trigger is intentionally squeezed. It prevents accidental discharge from a drop or parts malfunction.

Hammerless – A term used to describe a handgun whose hammer is concealed internally or one that uses a striker.

Hand – A small metal finger used to rotate a revolver's cylinder. The hand may be attached to either the trigger or the hammer.

Handguard – The part of the forend that covers the barrel and prevents the support hand from being burnt. Handguards are usually made of metal, wood, or polymer and are most often found on military-style rifles.

Handloading – Charging cartridge cases with primers, propellant, and bullets. Handloading is a way for operators and enthusiasts to manufacture their own ammunition. Handloading allows you control the quality and consistency of every round produced and save a few cents per cartridge.

Handgun – Any firearm that is intended to be fired from the hand with no support from the shoulder. Handguns usually have a barrel that is less than 16 in. and can be classified as one of the following: 1. Single shot; 2. Revolver; 3. Semi-Automatic; 4. Hand Rifle (Figure 6.1).

Hand Rifle – A rifle caliber firearm that is meant to be fired from the hands with no support from the shoulder. Hand rifles are usually built from rifle receivers with the absence of a buttstock and a barrel length of less than 16 in.

Headspace – The distance from the breech face to the portion of the chamber in which the cartridge seats during lock up. Rimfire cartridges headspace against the forward surface of the case rim. Bottleneck cartridges headspace against the shoulder of the cartridge. Straight-walled cartridges headspace against the ledge of the mouth at the top of the case. Belted cartridges headspace against the top edge of the belt (Figure 6.2).

Headstamp – Markings on the bottom of the cartridge case head used to identify caliber and manufacturer information (Figure 6.3).

Heel – 1. The top corner of the rear of the buttstock or buttplate. 2. The edge of the base of a bullet.



Figure 6.0- Various types of hammers in various positions. From left: A single/double-action speed hammer fully de-cocked. A single-action only hammer with integrated firing pin in half cock. A single-action only hammer fully cocked.



Figure 6.1- Various types and actions of handguns. Clockwise from top right: A short recoil operated, double-action only, striker fired polymer pistol. A short recoil operated, single/double-action, hammer fired pistol. A single/ double-action revolver. A short recoil operated, single-action only, hammer fired pistol. A single-action only revolver.

Helical Magazine – A type of detachable magazine that stores cartridges in a spiral pattern throughout the length of its body. Helical magazines provide a very high capacity in a very compact package. The complex design of a helical magazine requires intricate mechanics that are more likely to malfunction versus a conventional box magazine.

High Brass – A term to describe a shotshell that has a taller metal case head. The higher brass head is used to prevent paper hulls from burning due to larger propellant loads. The use of these taller heads has become obsolete since the introduction of plastic hulls that will not burn. Now the term is used to describe shotshells with hotter loads.

Hills and Valleys – A term used to describe the bearing surfaces of polygonal rifling inside a firearm's bore. Unlike lands and grooves in most typical rifling, the hills and valleys of polygonal rifling transition more smoothly, creating less bullet deformation as it passes through the bore.

Hollow-Base – A term used to describe a lead bullet whose base is concave. The hollow portion of the base will flare out from the pressure of the propellant gas. The flared base will provide good obturation. The hollow base will also shift the center of mass further forward changing the balance of the bullet and its characteristics in flight.

Hollow Point – A term used to describe a bullet whose tip is a concave cavity. Hollow point bullets are designed to expand and limit penetration when impacting soft tissue. Because of the hydrated nature of soft tissue when a hollow point impacts, hydraulic pressure forces the cavity in the nose of the bullet to expand and curl outward. The increase in diameter upon impact limits



Figure 6.2– Various pistol, rifle and shotgun cartridges and their headspace. Headspace is a critical dimension and could lead to a dangerous situation if not within spec.



Figure 6.3– Various case heads and head stamps. From left to right: TulAmmo 9mm Luger, FC (Federal Cartridge Corp.) 9mm Luger, PPU (Prvi Partizan) 45 Auto, CBC (Companhia Brasileira de Cartuchos) 45 Colt, LC (Lake City Ammunition) 05 (2005 manufacture) (5.56x45 NATO), LC 10 (2010 manufacture) (5.56x45 NATO resized to 300 Blackout), TulAmmo 7.62x39, LC 10 (2010 manufacture) (7.62x51 NATO), Made in USA (Federal Cartridge Corp.) 12 gauge.

the amount of penetration to the target and allows the projectile to transfer its maximum amount of energy. A form of hollow point bullet can also be used for precision. Jacketed hollow point rifle bullets sometimes feature a small cavity in the tip that is used to shift the center of mass to the base of the bullet for improved ballistic coefficient.

Holographic Weapon Sight – An electronic sight that uses laser beams to illuminate a reticle image that is projected into three dimensional space. The reticle image is recorded onto holographic film sandwiched in a viewing window. To reconstruct the holographic image, a laser passes through a collimator, and onto the holographic film. The film will refract the beam and project the reticle image. The eye will superimpose the image of the reticle onto the field of view.

Since there is no magnification, there is a single focal plane, which makes it easier to view the sight with both eyes open. Unlike the reflex or red dot sight, the viewing window is flat and does not require any reflective coatings, allowing more light to pass through to the shooter's eye and providing a brighter picture. Holographic sights may or may not be parallax-free.

Hook Rifling – A type of manufacturing process for rifling that is produced by a single-toothed tool that is repeatedly pushed or pulled through the bore while spiraling. The tool cuts one groove at a time to a slightly greater depth with each pass. It is then incremented to the next groove, the process repeated until all grooves are cut to the required depth. Hook rifling is a type of cut rifling.

Horizontal Magazine – A type of box magazine that attaches parallel to the barrel but stores the cartridges perpendicularly. Before being fed into the chamber the cartridges are rotated 90 degrees inside of the magazine. This type of magazine is unique to the FNH P90 and PS90 PDW.

Hydrostatic Shock (Hydraulic Shock) – A notion that a lightweight projectile traveling at extremely high velocity will create an incapacitating or fatal wound from a hydraulic pressure wave created when it contacts soft tissue. While still mostly theory, there is evidence to prove that there is a very large “temporary cavity” that is much larger than the actual wound channel that is created during the projectile's initial “dump” of energy. There is also evidence pointing to the pressure wave's remote effects on vital organs, blood vessels, the nervous system, and other tissues. There have been reports of brain hemorrhaging believed to be caused by a spike in blood pressure caused by hydraulic pressure waves. Although there is a significant amount of evidence to support the concept of hydrostatic shock, there is not enough evidence to support its ability to incapacitate or its fatality. There are many factors involved in terminal ballistics and the ability to incapacitate; hydrostatic shock is just one piece in the puzzle.

Ignition – The combustion of propellants from spark and heat. Ignition begins when the firing pin strikes the primer. The primer will shoot incandescent embers through the flash hole onto the propellant, igniting it.

Ignition Time – The time from which the primer is struck to when the bullet begins to move.

Improved Cartridge – A cartridge case that has been fire-formed to new dimensions of an improved chamber. Usually the new dimensions provide less taper at the shoulder and have greater case capacity.

Improved Military Rifle Powder (IMR) – The DuPont® powder trade name for single-based smokeless rifle propellants.

Incendiary – A type of small arms bullet that uses flammable material that ignites upon impact and creates a rapid burning fire.

Inertia Operation – A type of recoil-operated action used in high energy shotguns. Upon discharge, the barrel, receiver, and bolt head will recoil slightly back. The bolt head compresses an inertial spring located between the bolt head and body. Once fully compressed, the spring will rebound, forcing the bolt body back, unlocking the breech, and performing extraction, ejection, and cocking of the hammer. At the end of the bolt's stroke, the action spring will force it forward again. On its forward stroke the bolt will pick up a fresh round and lock it into the chamber. Inertia-operated actions are known for their light weight, fast cycling, and simplicity because there are only three main action parts: bolt body, bolt head, and inertia spring. The main disadvantage is there is more recoil transmitted to the operator.

Ingall's Tables – Ballistic tables calculated by Col. James Monroe Ingalls who was a soldier, and professor of mathematics, military science, and tactics. These tables are used to estimate velocities and trajectories for small arms projectiles. Ingalls first published these tables in 1918. These calculations were the most widely used ballistic tables before the introduction of computers and now, ballistic applications.

Inside Waistband (IWB) – A type of holster that is worn inside the pants and is secured by a belt or to the waistband. It is used for concealed carry purposes because of its ability to hide the profile of a pistol under clothing (Figure 6.4).



Figure 6.4– An inside the waistband holster is the best choice for concealment of most sizes of pistols. IWB holsters are also very versatile in terms of placement.

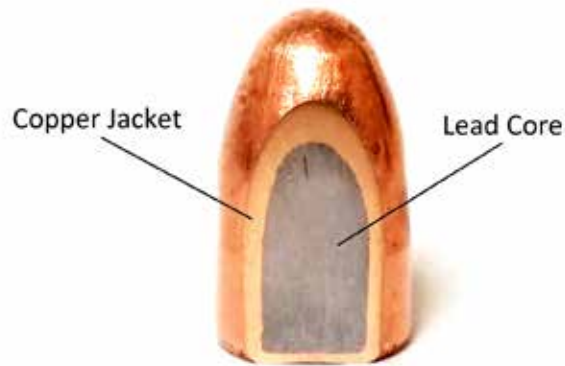


Figure 6.5- A partial copper jacket over a lead core. Uniform jacket thickness is crucial to bullet stabilization in flight.

Internal Ballistics – A part of the science of ballistics that deals with the behavior of the bullet from ignition to the point where it exits the muzzle. There are many factors that are involved in internal ballistics such as ignition time and dwell time, propellant, chamber pressure, friction, and rifling design. Also known as interior ballistics.

Iron Sights – The most common type of aiming device consisting of some form of alignment tabs. Iron sights use some type of front post or blade and a rear notch or aperture. The front and rear sights serve to align the bores axis with the operator's eye and the target providing proper sight picture.

J

Jacket – The outer envelope of a bullet comprised of copper, copper alloy, or steel. The jacket may cover all or part of the core and can be bonded in different ways. The use of copper or copper-plated steel jackets reduces the amount of lead fouling and allows for higher velocities without the risk of the soft core deforming (Figure 6.5).

Jag – An accessory used to aid in cleaning the bore of a barrel. A jag is rod-shaped and has a serrated outer surface used to grip cleaning patches.

Jeweling – An aesthetic treatment used to enhance the looks of firearm parts, such as the bolt. The look is created with an abrasive or wire brush and compound that roughs the surface of the metal in a circular pattern (Figure 6.6).

Jump – Vertical rise of the muzzle due to recoil. Muzzle jump can be cured with the use of more weight near the muzzle, ports, or a brake. Also known as muzzle rise or flip.



Figure 6.6- Jeweling on the barrel flats, water table and underside of the forend of a side-by-side, break-action 10 gauge shotgun.

K

Keyhole/Key Holing – An oblong hole left in a target from a bullet wobbling or tumbling and impacting sideways. Key holing can occur from insufficient rotational momentum, imbalances of the bullet or deflection.

KeyMod – A universal accessory mounting platform designed to be superior to the Picatinny rail. Developed by VLTOR Weapons Systems in conjunction with Noveske Rifle Works, the design was released into the public domain for universal use and commonality in the firearms industry. The name comes from VLTOR's use of "mod" for modular and "key" coming from the mounting slots keyhole profile. The KeyMod system utilizes two components, The KeyMod slot and the KeyMod nut. The nut is designed to pass through the hole and lock into the slot. The KeyMod system is designed to be a lighter, more ergonomic, direct attachment point for accessories like, lights, lasers, grips, and optics (Figure 6.7).

Kick – The force of recoil exerted against the shooter's hand and/or shoulder.

Kinetic Energy (KE) – The energy an object possesses due to its motion. Also, the force needed to move a specific weight a specific velocity. For example, if a projectile that weighs 62 grains was pushed to 3,100 feet per second, it would require 1,323 pounds of force to accomplish this acceleration. Now that this 62 grain projectile is moving at 3,100 feet per second, it will retain its energy until it starts to decelerate or its energy is transferred.

The formula for kinetic energy is:

$$.5(\text{constant}) \times \text{mass (m)} \times \text{velocity (v)}^2 = \text{KE}$$

This formula can be modified to calculate bullet energy.

L

Laminated Stock – A long gun stock that is made up of several layers of wood that are glued or epoxied together under pressure. Laminated stocks are completely resistant to warping, which can affect accuracy due to stresses applied to the barrel and action.

Lands and Grooves – The spiraling channeled and raised portions of the bore that compose the rifling. Lands and grooves are most typically found in Enfield-type rifling (Figure 6.8).

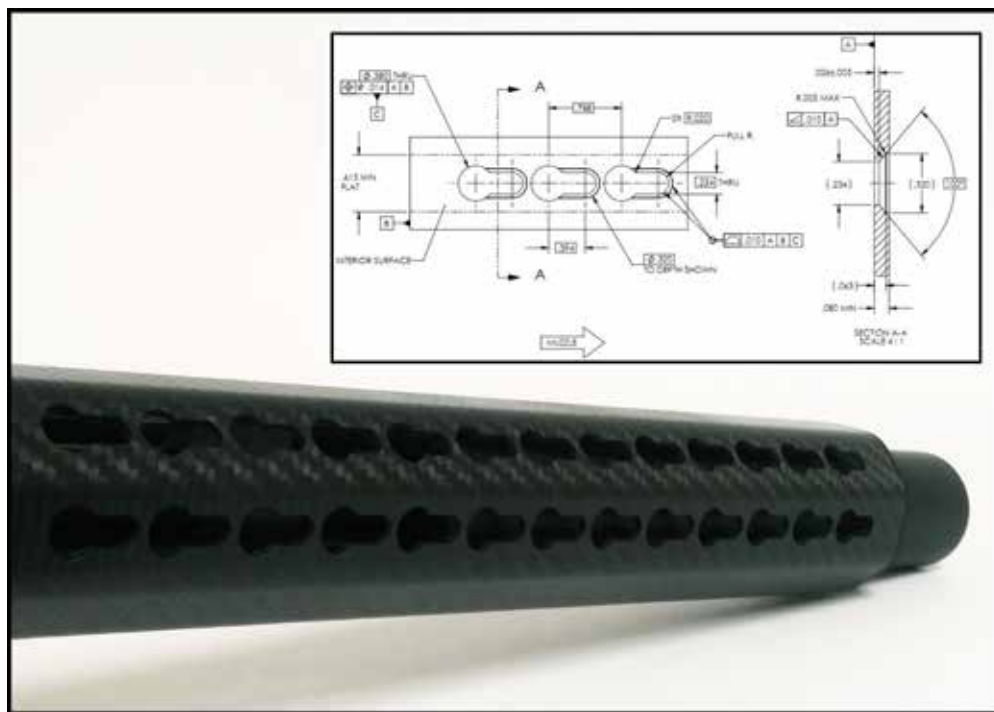


Figure 6.7– With a surplus of keymod slots at various angles and locations around this handguard you can mount any accessory in the precise location you require.

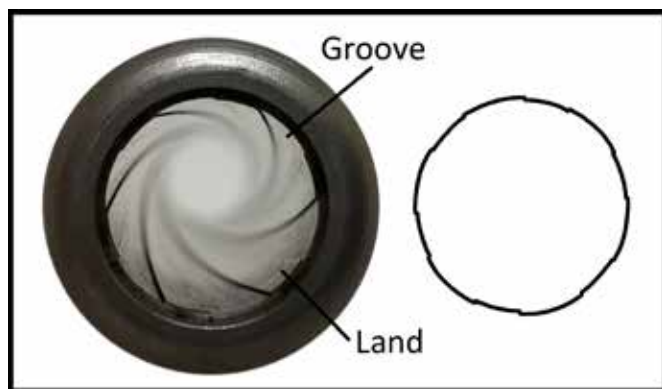


Figure 6.8- The pronounced lands and grooves of Enfield style rifling are used to impart spin on the bullet to stabilize it in flight.

Land-Groove Ratio – The proportion of the surface area of the lands and grooves. Typical land-groove ratio is 40/60: 40 percent land surface and 60 percent groove surface. The ratio can be as low as 20/80. A low ratio with a small land area may decrease friction, and increase velocity. A high ratio with wider lands may increase barrel life because of the increased bearing surface.

Lap/Lapping – A method of polishing bearing surfaces such as bores and rails with a very fine abrasive compound. Lapping a bore also requires the use of a molded slug usually composed of lead, which is impregnated with compound. The slug is reciprocated with great care to remove tool marks without altering the dimensions of the bore or its rifling.

Lead – A heavy, soft, moldable metal. Lead or lead alloys are the main material used in bullet cores.

Lead Styphnate – A stable primary explosive used in modern day primers. Lead styphnate is used along with other chemicals to form the priming compound. Lead styphnate has been the main priming ingredient since the late 1920s, replacing the extremely corrosive mercury fulminate.

Lead Units of Pressure (LUP) – Similar to copper units of pressure (CUP), but instead of a copper slug a lead slug is used. Lead units of pressure are used to measure the chamber pressure of shotgun shells.

Leading – The accumulation of lead or lead alloy inside of the bore of a firearm. Excessive leading can ruin accuracy and may lead to dangerous pressure levels. Leading is caused by lead bullets that are too soft, inadequate lubrication, or roughly finished rifling.

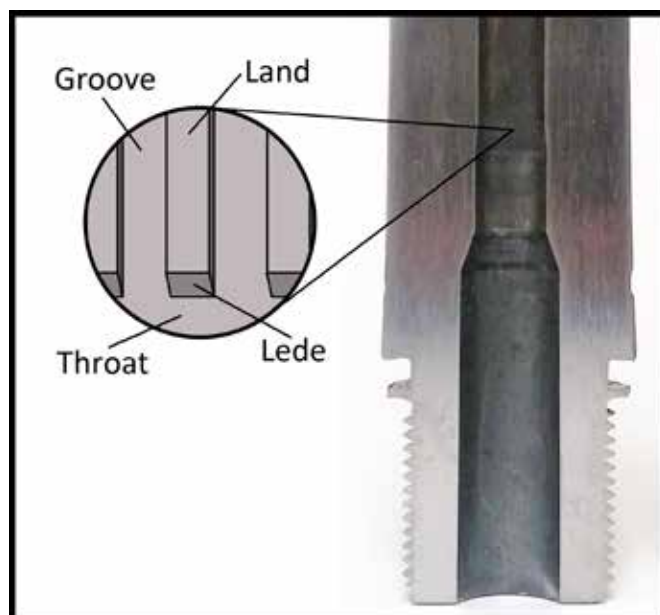


Figure 6.9- The beveled portion of the leading edge of the rifling is used to guide and center the bullet into the bore.

Lede (Leade) – The beveled portion of the rifling ahead of the throat of the chamber that centers and guides the bullet into the bore (Figure 6.9).

Length of Pull (LOP) – The distance from the face of the trigger to the back of the buttstock. The average length of pull of most rifles and shotguns is about 13.5 in., with youth models coming in 1 in. - 2 in. shorter. Getting proper length of pull will help to avoid reaching for controls and will provide a more natural shooting position, as well as create consistent eye relief for magnified optics.

Lever-Action – A type of firearm action that is operated by a hinged handle that usually doubles as a trigger guard. When the lever is operated down and forward it unlocks the breech and extracts the cartridge case. It then pushes the bolt rearward, cocking the hammer. On its return stroke it feeds a new cartridge into the chamber and locks the breech in preparation for firing (Figure 7.0).

Lift – A force applied to the body of a projectile that is perpendicular to the flow of air. Lift is a product of deflection and pressure differences. If the projectile was pointing nose up, the underside of its body would deflect air down. Air would react by creating an upward force. There is also a pressure increase when force is applied.

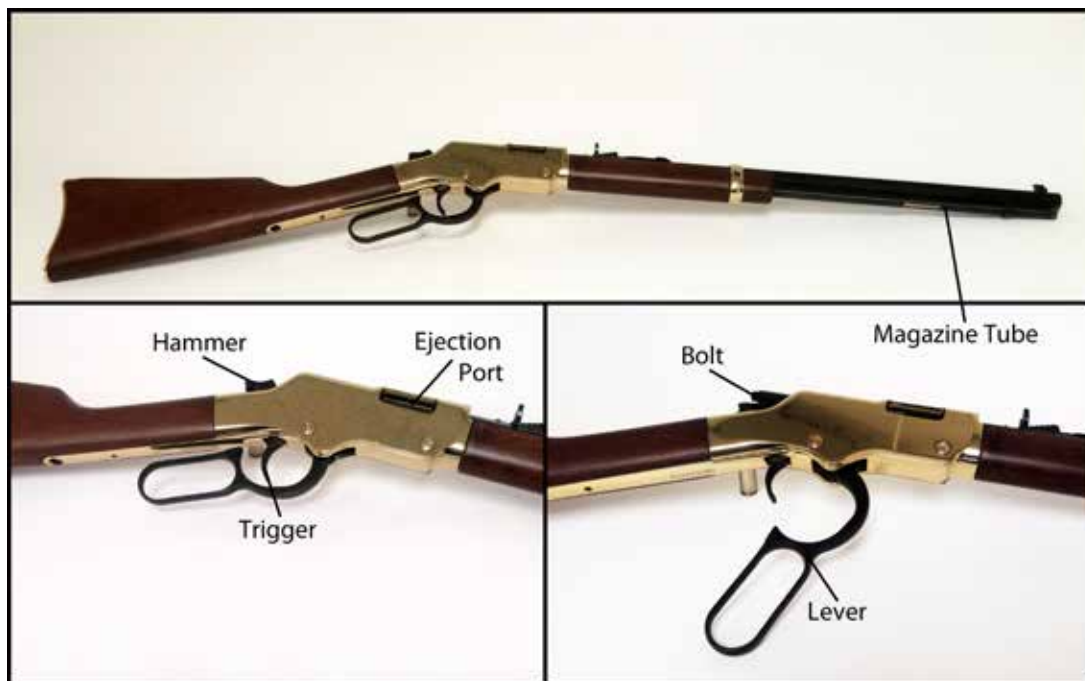


Figure 7.0–

Henry Golden Boy .22 Long Rifle, lever action rifle. Bottom left: The lever is closed and the breech is locked and ready to fire. Bottom right: The lever is open, the bolt is to the rear, the fired case has been ejected and is ready to feed a new cartridge and fire again.

When the wing deflects air down and creates a downward force, it also creates higher pressure or denser air. There will always be higher pressure air on the side of deflection and low pressure air on the opposite side. The term “lift” is often associated with ascent or opposing gravity. Since lift is dependent on the flow of air and not gravity, its force can be generated in any direction. A projectile whose angle of attack is parallel to the flow of air will experience drag. Any time a projectile's angle of attack is not parallel to the flow of air it will experience lift. Lift will never cause the bullet to rise above the bores axis, but it will cause the bullet to nutate and precess (Figure 7.1).

Line-of-sight –The invisible line from the eye through the centerline of the sights to the point of aim. Also the imaginary line from the eye to the target.

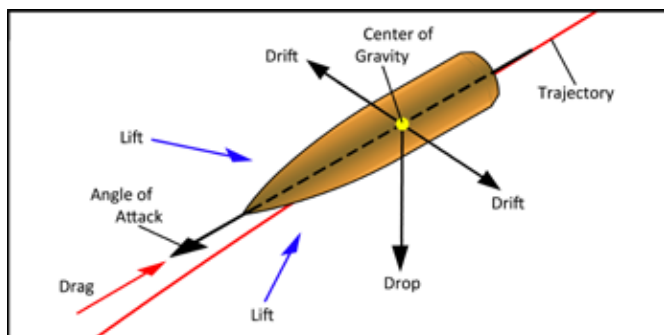


Figure 7.1– Unless air pressure is acting parallel to the projectile's angle of attack creating a drag component, it will create a lift component causing the bullet to drift on top of the high pressure air.

Load – 1. In reloading it is a very specific combination of components that are consistent from one cartridge to the next. Consistency of bullet and propellant weight and cartridge dimensions will ensure higher precision. 2. As a verb it refers to inserting a cartridge into the chamber and preparing to fire.

Loading Density – The ratio between the volume of propellant to case capacity.

Loading Gate – 1. A covered port in a long gun's receiver. The door in the port is hinged so cartridges may be inserted into the magazine. 2. On some revolvers a hinged part that swings out, exposing the chambers of the cylinder for loading and unloading.

Locking Lug – Small projections around the circumference of the bolt that fit into corresponding grooves in the front of the receiver or barrel extension. The locking lugs serve to secure the bolt from unlocking while a cartridge is being discharged (Figure 7.2).

Lock Time (Clock Speed) – The time, measured in milliseconds, from when the sear releases the hammer/striker and ignition begins. Fast lock time can be beneficial because it leaves less time for human error to move the point of aim before the bullet leaves the muzzle.

Lockup – A term used to describe the fitment of the action parts when they are in battery. Lockup can be used to describe the fitment of the slide/breechblock/

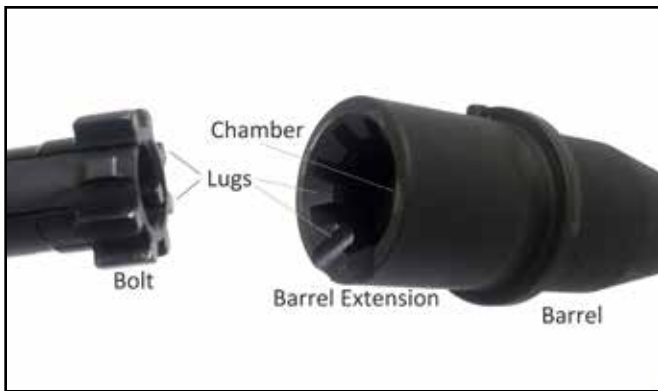


Figure 7.2- The lugs on the bolt coincide with the slots in the barrel extension. When the bolt rotates inside the extension its lugs will align with the extensions and lock the chamber closed.

bolt to the barrel, and their relationship to the receiver. Tight tolerances create a solid lockup and lead to greater accuracy and precision. Solid lockup can be detrimental to the reliability of a semi-automatic firearm when it encounters dirt and debris, possibly causing malfunctions, so a compromise must be reached.

Long Gun – A term used to describe a rifle or shotgun or other firearm that uses a stock.

Long Recoil – A type of recoil-operated action found primarily in autoloading shotguns. After discharging a round, the barrel and breech or bolt will stay locked while recoiling back. At the end of its stroke the bolt will unlock from the barrel and remain rearward, cocking the hammer. As the barrel moves forward it will extract the spent case. Once the barrel is locked in the forward position, the bolt moves forward, loading a fresh round and locking the breech.

Long Slide – A pistol slide and barrel that is longer than normal. For example, the 1911A1 and Glock 17 have 5 in. and 4 in. barrels respectively, but both models feature a long slide version with 6 in. barrels.

Low Base – A shotshell case that uses a low base wad to create more space for propellant and shot for magnum and heavy loads.

Low Brass – A shotshell with a short metal case head that are used in lower power loads.

M

Machine Gun – A large, automatic firearm that is typically chambered for rifle cartridges .50 caliber or larger. Although there are many classifications of machine guns (light, medium, heavy, general purpose) even the light machine gun usually requires more than one person and support to fire. Medium to heavy machine guns are typically mounted on a tripod or a vehicle. There are some exceptions, such as the M249 squad automatic weapon (S.A.W), which is a light machine gun that fires a .22 caliber projectile and is operated by one person.

Machine Pistol – A handgun that fires automatic or in bursts.

Machine Revolver (Semi-Automatic Revolver) – A revolver that uses energy from expanding gas from a port in the barrel to cycle the action. The term “machine” is misleading because it may imply the revolver fires automatically, but they actually fire in semi-automatic mode only. One trigger squeeze results in one round discharged.

Magazine – A part of a repeating firearm that stores cartridges in preparation for feeding. A magazine can be an integral part of the firearm with a fixed magazine or detachable like a box magazine. Detachable magazines can be found in numerous configurations from single,



Figure 7.3- Various types of external box magazines. Clockwise from top left: A 60 round rifle casket magazine, an 8 round single stack pistol magazine, a 17 round double stack pistol magazine, a 30 round double stack rifle magazine, a 10 round rotary box magazine, a 10 round single stack magazine in a double stack body.

double, or quad stack (casket), or arranged in a loop or helix like in a drum, rotary, or helical magazine. There are also some magazines that house the cartridges perpendicular to the bore's axis, known as horizontal magazines. A magazine usually consists of a body, spring, follower, and floorplate (Figure 7.3).

Magazine Catch (Release) – A device that is used to hold the magazine in place until it is depressed, releasing the magazine.

Magazine Safety – A device used on some semi-automatic pistols that prevents them from firing with the magazine removed.

Magazine Tube Extension – A screw-on attachment for shotguns that increases the capacity of the stock magazine tube by two to six cartridges.

Magazine Well – An opening in the receiver of a long gun or handgun grip that accepts magazines (Figure 7.4).

Magazine Well Extension – An accessory used on semi-automatic firearms that attaches to the magazine well. It serves to funnel the magazine into the well and aids in faster reloading.

Magnified Optic – A term that refers to a telescopic sight. A magnified optic uses a lens to enlarge the image in the field of view. Not all optical aiming devices are magnified, as in the case of holographic and red dot sights.

Magnum Cartridge – A cartridge that has more volume and propellant than a cartridge of the same caliber. For example, the .44 Special and the .44 Magnum use the

same diameter bullets, but the magnum case is about $\frac{1}{10}$ in. inch longer and can hold five more grains of propellant.

Magnus Effect – A force that is applied to a projectile as a reaction to airflow, wind and rotation. The Magnus force acts perpendicular to the bullet's center of form, and the direction of the flow or air. The Magnus effect also depends on the direction of rotation and will always react to the top of the projectile's spin. A projectile spinning against the wind (clockwise rotation with a wind from the right) will experience a downward force while a projectile spinning with the wind (clockwise rotation with a wind from the left) will experience lift. A projectile spinning against the wind will create a high pressure area above it that will push the bullet down, creating a lower point of impact. A projectile that is spinning with the direction of wind will create a high pressure area below it, allowing the bullet to “skid” on the high pressure area creating a higher point of impact. The Magnus effect is not a fundamental physical effect, but rather a phenomenon that occurs with spinning objects and their disruption of airflow. The Magnus effect is a component of wind drift and will affect a projectile's drop. The effect is named after German physicist Heinrich Gustav Magnus (Figure 7.5).

Match Grade – A term to describe barrels and parts that are designed with competition in mind. Match grade parts are usually made of high quality materials with very tight tolerances for increased precision.

Mean Radius – A method of measuring precision for both firearms and ammunition. It is accomplished by finding the exact center of a group then averaging the distance of each shot from that center. Mean radius is a measurement that is used mostly by the military (Figure 7.6).

Meplat – The blunt end of the nose of a bullet or the diameter of the tip. The smaller the diameter of the meplat, the higher a projectile's ballistic coefficient and ability to defeat drag.

Metallic Cartridge – A term used to describe metal-cased cartridges. Modern cases are made from copper, copper alloy, or steel, as opposed to older cases made from paper or linen.

Micro-Groove Rifling – A type of rifling that uses numerous lands and grooves. Unlike conventional Enfield rifling that uses up to 6 lands and grooves, micro-groove rifling uses up to 16 lands and grooves. Each groove is typically shallower than conventional rifling. Since the grooves are shallower than normal, their imprint on



Figure 7.4- Clockwise from top center: A semi-automatic rifle magazine well, a semi-automatic pistol magazine well, an oversized, flared magazine well used on a semi-automatic pistol for competition.

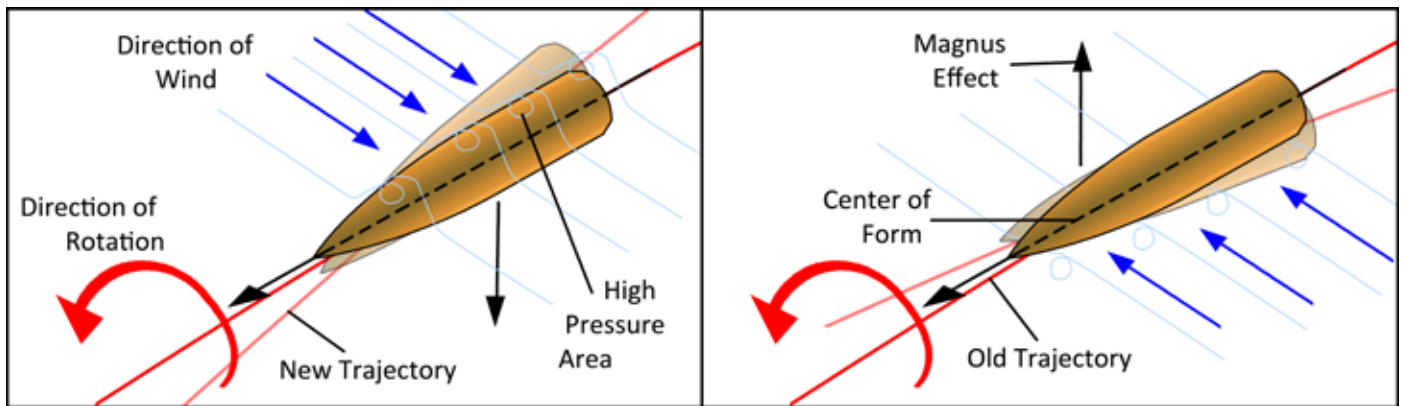


Figure 7.5- A projectile spinning into the wind will experience drop, while a projectile spinning with the wind will experience lift.

the bullet is shallower, imparting less deformation on the bullet. The shallower grooves can also be a downfall of micro-groove rifling because they can become filled with lead or other fouling, reducing their effectiveness. Excessive leading can also lead to dangerous pressure levels inside the bore.

Mid-Range Trajectory (MRT) – Approximately half the distance a projectile will travel from muzzle to target. Since the projectile follows a parabolic arc-shaped trajectory, its MRT is also its point highest above the line-of-sight.

Military Pattern Rifle – A copy of an assault rifle that appears to be similar but fires in semi-automatic versus automatic or in bursts. An example would be a semi-automatic AR-15 that looks identical to its automatic counterpart the M-16.

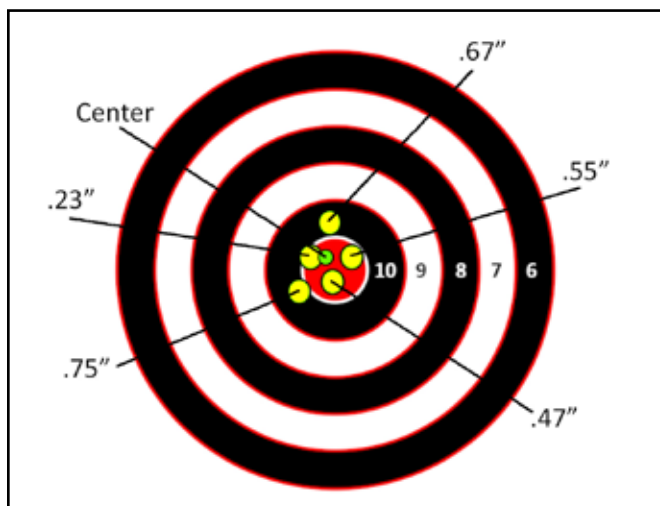


Figure 7.6- Once the center of the group has been located, mean radius can be calculated. In this 5 shot group mean radius is calculated:

$$.23 + .75 + .47 + .55 + .67 = 2.67 / 5 = .534$$

The mean radius of this group is .534", meaning on average each shot will only deviate .5in. from the center of the group.

Miller Twist Rule – A mathematical formula used to calculate the optimal twist rate for specific bullets. Don Miller created his formula to calculate twist rates more precisely than the Greenhill formula with the inclusion of mass. All that is needed to calculate twist rate is bullet mass (m) in grains, diameter (d) in inches, and length (l) in calibers (length in inches divided by diameter). The answer will be expressed in calibers per turn (t), but can be converted to inches per turn (T) by multiplying by the diameter (d). To calculate for (t) you need the square root (SR) of:

$$SR \text{ of } 30(\text{constant}) * X m / 2(\text{constant})^{**} X d^3(\text{cubed}) X l (1 + l \text{ squared}) = t$$

For example, a .224 diameter (d) bullet, .905 in. (4.04 calibers) long (L) weighing 62 grains (m) will need a twist rate of:

$$\begin{aligned} & 30 X 62(m) / 2 X .224(d) X .224(d) X .224(d) \\ & X 4.04(l) (1 + 4.04(l) X 4.04(l)) = t \\ & 1,860 / 0.09 (17.32) = t \\ & 1,860 / 1.558 = t \\ & 1,193.83 = t \end{aligned}$$

The square root of 1,193.83 is 34.55 or 34.55 calibers per turn. To solve for (T) just multiply by (d) or .224.

$$34.55 (t) X .224 (d) = 7.73 \text{ or a twist rate of } 1 \text{ turn in } 7.7 \text{ in. or } 1:7.$$

**The constant 30 is a product of an average velocity of 2,800 fps, a temperature of 59° Fahrenheit, and a pressure of 750mm mercury and 78% humidity.*

*** The constant 2 is a "safe" number based on a known number that will stabilize a projectile based on the Miller stability factor.*

Miller Stability Factor (SF) – A scale that gauges how well a given twist rate will stabilize a specific bullet. An SF of less than 1 will not properly stabilize a bullet. An SF between 1 and 1.4 will offer marginal stabilization. An SF of 1.5 or greater will be more than adequate enough to properly stabilize a bullet. To calculate SF you

need to know bullet mass (m) in grains, diameter (d) in inches, length in calibers (l) (length in inches divided by diameter) and twist length (t) in calibers per twist (twist in inches divided by bullet diameter). To calculate SF use this formula:

$$30 \times m / t^2 \times d^3 \times l (1 + l) = SF$$

For example a .224 diameter (d) bullet, .905 in. (4.04 calibers) long (l), weighing 62 grains (m) shooting through a 1:7 (1 turn in 7 in. or 31.25 calibers) (t) will have an SF of:

$$30 \times 62(m) / 31.25(t) \times 31.25(t) \times .224(d) \times .224(d) \times 4.04(l) (1 + 4.04(l) \times 4.04(l)) = SF$$

$$1,860 / 44.34 (17.32) = SF$$

$$1,860 / 768.02 = SF$$

$$2.42 = SF$$

A stability factor of 2.42 means that a 1:7 twist rate is more than capable of stabilizing a bullet .905 in. long.

**The constant 30 is a product of an average velocity of 2,800 fps, a temperature of 59° Fahrenheit, and a pressure of 750mm mercury and 78% humidity.*

Minute of Angle (MOA) – A unit of angular measurement that is equal to $\frac{1}{60}$ of 1 degree or 1.05 in. at 100 yd. A 1 moa firearm is capable of shooting groups no larger than 1 in. at 100 yd. A 1 moa firearm will shoot 2 in. at 200 yd., 3 in. at 300 yd., and so on.

Moment of Inertia – A effect of rotating objects that explains their resistance to change in the angle of their rotation axis. The moment of inertia of a projectile prevents it deviation from its trajectory from nutation and precession. Moment of inertia will keep a projectile spinning around its axis uninterrupted until an outside force acts upon it, changing the angle of its axis. Moment of inertia is a product of mass rotating around an axis (Figure 7.7).

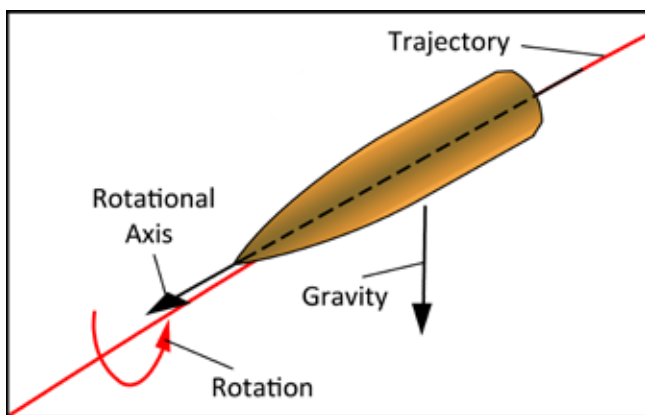


Figure 7.7– A projectile will continue to spin around its axis like a toy top, until acted upon by an outside force (air pressure and gravity).

Momentum – Mass in motion. Momentum (P) of an object is the product of its mass (M) and velocity (v): $P=MV$

Mouth – The open portion of the cartridge case where the bullet is inserted (Figure 7.8).

Muzzle – The end of the barrel where the bullet exits. The muzzle plays a critical role in a firearm's accuracy and precision because it is the last portion of the barrel to come in contact with the bullet. The shape and concentricity of the crown is important because it helps transition the bullet and expanding gas from the muzzle into open air. The muzzle is important to transitional ballistics.

Muzzle Blast – The violently loud sound and extreme pressure that exit the muzzle after discharging a cartridge. Expanding gas will exit the muzzle at five times the speed of sound, with pressures reaching upwards of 50,000+ psi. The projectile will also exit the muzzle faster than the speed of sound in most cases. The loud “crack” that is heard is a result of a shock wave created by the velocity of the gas and projectile. It is similar to the “sonic boom” of planes flying faster than Mach 1. Muzzle blast can create sound pressure levels exceeding 140 decibels. Exposure to decibel levels that high can lead to hearing damage or permanent loss.

Muzzle Brake – A device that is either attached to the muzzle or is an integral part that is used to redirect gas backward. A muzzle brake is used to reduce the amount of felt recoil. The gas that is directed backward creates a forward thrust on the firearm and effectively reduces the amount of recoil. A brake differs from a compensator that directs gas upward to counter muzzle rise (Figure 7.9).



Figure 7.8– Once the bullet is inserted into the mouth of the case, it is crimped and the cartridge is complete.

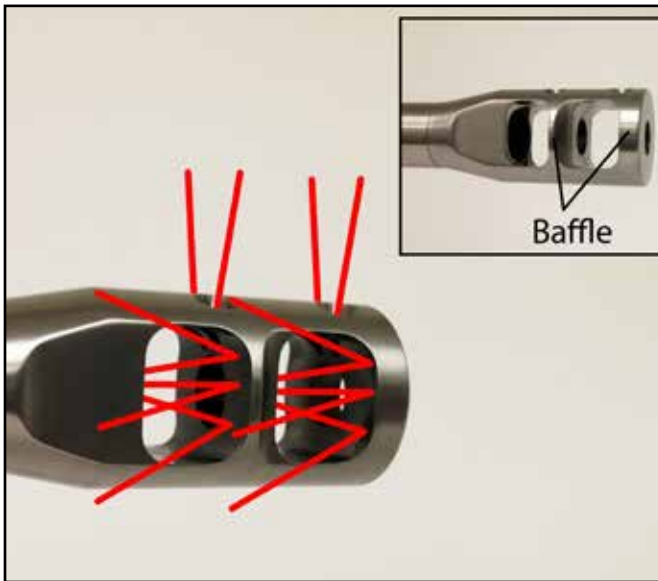


Figure 7.9- Redirecting the flow of gas, and thus directing thrust will counteract the force of recoil. This brake also features top ports used to counter muzzle rise/flip.

Muzzle Energy – The measurement, expressed in foot-pounds force of the energy exerted by a bullet as it exits the barrel. See also *Bullet Energy*.

Muzzle Flash – The bright light and sparks seen exiting the muzzle after discharging a cartridge. Flash is a result of fuel-rich propellant that is still combusting as it exits the muzzle, mixing with oxygen in the atmosphere around it. Longer barrels will have less flash than shorter barrels because they allow more time for the propellant to fully burn before the bullet exits the muzzle. The amount of flash is also dependent on the composition of the propellant. Some propellants are designed to be “low flash” with the addition of certain chemicals.

Muzzle Rise/Flip – The tendency for firearm's muzzle to elevate during firing. The primary contributor to muzzle rise is a high bore axis above the shooter's grip and support hands (Figure 8.0).

Muzzle Velocity – The speed of the projectile as it exits the barrel, expressed in feet per second.

N

Naked Bullet – A bullet that is not covered by a jacket.

National Association of Federally Licensed Firearms Dealers (NAFLFD) – A firearm industry trade alliance comprised of manufacturers, distributors, and dealers.

National Firearms Act (NFA) – Title II of federal firearm law, regulates the manufacturing and transfer of certain types of firearms and imposes an excise tax on them. Automatic- and select-fire-capable firearms, short barrel rifles and shotguns (less than 16 in. and 18 in. respectively), Any Other Weapons (AOW), and silencer/suppressors are all regulated under the NFA. The Gun Control Act of 1968 is Title I.

National Match Ammunition – Ammunition of outstanding quality and precision, manufactured for or by the U.S. government for use in National Match competition. The ammunition can be identified by the headstamp “NM”. Boxes will be marked match grade or for National Match.

National Match Pistol and Rifle – Military firearms that are specifically manufactured for use in National Match competition. These firearms must meet precise standards for precision and function.



Figure 8.0- Muzzle rise can be contributed to design. The higher the firearm's bore axis (red line) is in relation to the operator's hands, the more prevalent flip will be. The closer the bore's axis is to the center of the operator's hands the easier it will be to control flip.

National Rifle Association (NRA) – An independent, non-profit organization founded in 1871 to protect the second amendment rights of all citizens to keep and bear arms. The NRA also promotes firearm safety, training, marksmanship, hunting, and self-defense. The NRA is also the governing body of U.S. competitive rifle and pistol shooting, as well as holding position in both U.S. Olympic and International Shooting Union committees. The NRA also has an official publication: *The American Rifleman*.

National Shooting Sports Foundation (NSSF) – A trade association for the firearms industry, formed in 1961 to promote, protect, and preserve hunting and shooting sports. The NSSF has a membership of over 7,000 manufacturers, dealers, retailers, shooting ranges, organizations, and publishers.

Neck – The upper portion of a cartridge case that the bullet seats into. In a bottleneck cartridge case, the neck is the area just ahead of the shoulder (Figure 8.1).

Necking Down/Up – A term used to describe decreasing (or increasing) the diameter of the cartridge case mouth and neck to accept smaller (or larger) diameter bullets. Necking is a common practice in wildcatting.

Night Sight – Any firearm sight that is designed or modified to be more visible in low light to no light situations. Night sights may be painted bright colors

with fluorescent or phosphorescent (glow-in-the-dark) paints, use light collecting fiber optic tubes or radioactive gas (tritium), or use electronics (Figure 8.2).

Nobel, Alfred B. – A Swedish-born inventor, chemist, and engineer. Nobel is most famous for inventing dynamite. Nobel also invented ballistite, a smokeless propellant that was a forerunner to cordite. Nobel held nearly 350 patents. Upon his death, Nobel's fortune was used to establish the Nobel Prize for accomplishments in many fields. Nobel lived from 1833–1896.

NonCorrosive – A term to describe primers or percussion caps that do not contain potassium chloride, a chemical that forms salts that attract water when oxidized. These salts in turn cause rusting inside the bore.

North Atlantic Treaty Organization (NATO) – A military and political alliance of countries from Europe and North America. There are currently 28 member countries who have signed the treaty since its adoption on April 4, 1949. NATO serves to safeguard the freedom and security of its member nations through military or political means. NATO's headquarters are located in Brussels, Belgium.

Nose – The point or tip of a bullet or cartridge.

Nutation – A rocking or nodding motion along the center of form of a projectile. Nutation motion is also known as wobble. During flight, if any of the projectile's centers (form, mass, pressure) are not aligned or it is not properly stabilized, the bullet will begin to nutate. The wobble comes from external forces such as air, gravity, and wind that act against the projectile and force its rotational axis to deviate. The moment of inertia of the spinning projectile works against the outside forces and tries to correct the deviations. These forces working against each other cause the projectile to wobble. These forces will also cause a projectile to precess (Figure 8.3).



Figure 8.1- It is crucial for the case neck to be concentric because any inconsistency will cause misalignment of the bullet and bore, leading to suffering precision.

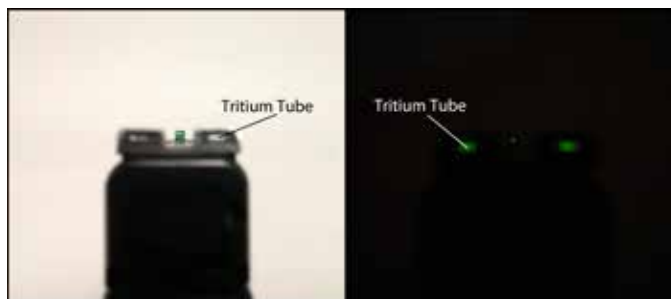


Figure 8.2- During the day the tritium tube's light is not visible, but in low light/no light situations they glow very brightly.

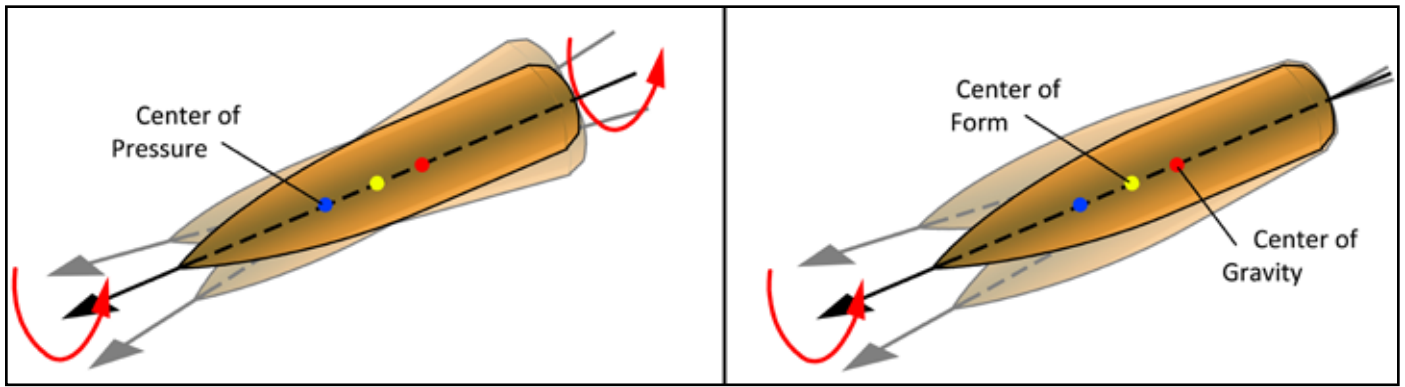


Figure 8.3- On the left the projectile's movement is known as nutation. Both ends of its axis are rotating around its center of form. On the right the projectile's movement is known as precession. Only one end of the projectile's axis is moving while the opposite is fixed.

O

Obturation – The act or ability of a bullet to seal off the bore from expanding gas jumping ahead of it after ignition. A bullet that can form a near gas-tight seal exhibits good obturation.

Offset Sights – 1. Sights that are arranged in such a way that they allow a shooter with cross-eye dominance to use their left eye while shooting from the right shoulder or vice versa. 2. Iron sights that sit offset from the plane of a telescopic or other sight, usually 45 degrees. Offset sights allow the operator to switch between two different sighting systems. Going from the primary optic to the backup sights only requires the operator to rotate the firearm 45 degrees around its bores axis (Figure 8.4).

Ogive – The rounded, tapered end of a bullet just ahead of its bearing surface. The shape of the ogive will directly affect ballistic coefficient and the way a projectile will defeat drag. Sharper ogives featured on high velocity rifle bullets will “cut” through air better than pistol bullets with blunt, rounded noses.

Open Bolt – A general term used to describe a firearm action that begins its cycle with the bolt locked to the rear of the receiver. Squeezing the trigger releases the bolt that starts moving forward under operating spring pressure. Moving forward, the bolt will strip a round from the magazine, feed it into the chamber, and lock the breech. The open bolt-action is found more commonly with automatic and select-fire guns. It is favored over

the closed bolt design because it allows air to cool the chamber between shots and prevents a condition known as cook-off. The open bolt design does not lend anything toward accuracy or precision, because during lock time there are many factors that disrupt point of aim.

Oscillation – A repetitive back and forth motion. In a wave, the motion from the highest point to the lowest point represents one oscillation. The difference from the highest point of the wave to the lowest is its amplitude. The number of oscillations in a given period of time is frequency. Different frequencies can drastically change the amplitude of the oscillations because of resonance (Figure 8.5).



Figure 8.4- Offset sights allow the operator to switch between a mid-long range optic and close range iron sights by simply canting the firearm 45 degrees.

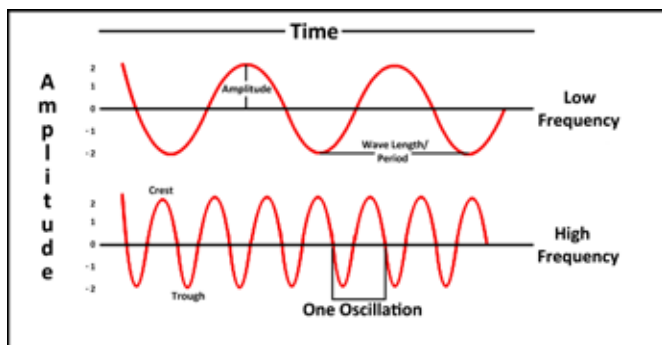


Figure 8.5- The frequency at which a barrel is oscillating during firing can greatly affect accuracy and precision. By free floating a barrel it will consistently maintain its natural frequency oscillations and produce tighter groups.

Overbore – A ratio between cartridge case capacity and the diameter of the bore. A higher case capacity to bore diameter ratio (bottleneck cartridge) will usually contribute to very high velocity, high energy cartridges. Very high ratios will result in shorter barrel life due to more stress and wear.

Overpressure Ammunition (+P/+P+) – An official SAAMI designation for ammunition loaded to higher than normal pressure, but lower than proof pressure. The increased pressure (10 –15 percent) creates higher velocities, more energy, and increased recoil. Overpressure ammunition is intended to increase the effectiveness of standard calibers such as .38 Special, 9x19mm, and .45ACP. +P is usually reserved for use as self-defense

and duty ammunition, and not for general shooting and plinking. Not all firearms of a certain caliber are built to handle the increased pressure of +P, so check your owner's manual before using it in your gun.

Over-travel – A condition in a firearm's trigger, where it continues through its stroke beyond the release of the sear. Eliminating over-travel can help accuracy and precision by eliminating unneeded movement during dwell, ignition and lock time.

Over-Under Shotgun – A type of double barrel shotgun that consists of two barrels stacked vertically. Over-unders are always break-action and typically used for hunting and sporting clays.

P

Palm Rest – An adjustable attachment for the bottom of a rifle's grip that provides a shelf for the hand to rest in a consistent manner every time it is placed on the grip.

Palm Swell – A portion of the grip with increased material in the palm region. Palm swells are used to provide more contact surface to accommodate a more secure grip.

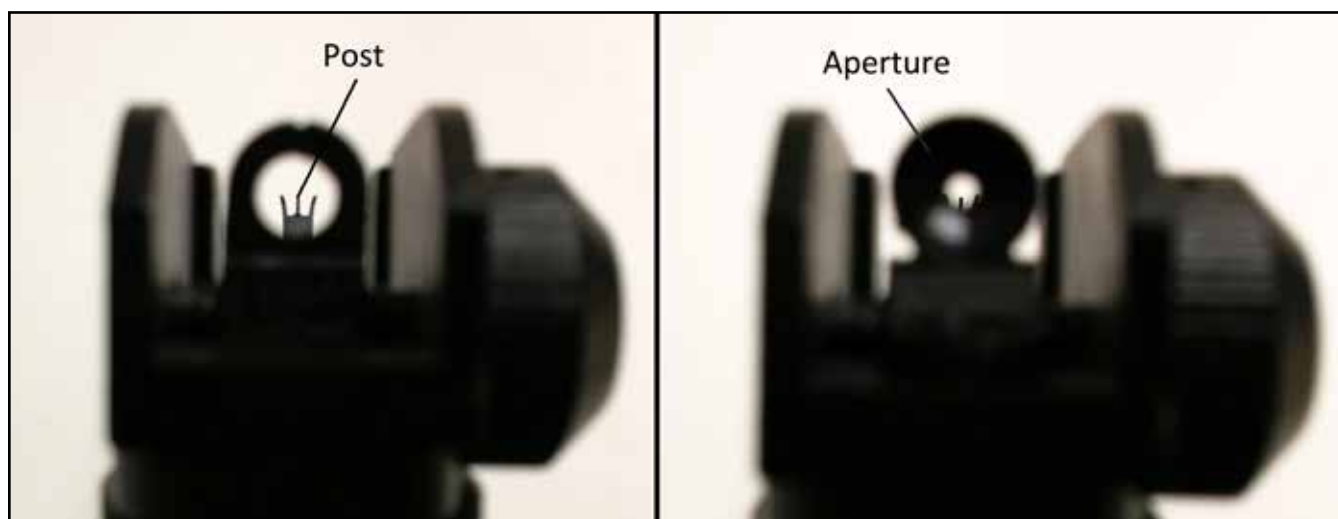


Figure 8.6- The large aperture of the sight on the left is good for fast sight acquisition and low light shooting. The small aperture of the sight on the right is good for long-range precision shooting. The large aperture allows more light to pass through its opening, while the small aperture does not permit as much chance of sight misalignment.

Parallax – The visual displacement of a telescopic sight's reticle in relation to the point of aim. It is an optical error in which the reticle is not in line with the optical axis because the optics is not focused correctly for a given distance. When the operator's eye is moved vertical or horizontal of the optical axis, the reticle will appear to move from the target. Some scopes have built in parallax settings for a given distance and some have adjustable parallax settings that use an optical element to project the target and the reticle on the same optical plane.

Peep Sight – Also known as aperture sights, a type of open sight that uses a standard post or bead front sight and a rear sight aperture. The aperture can range from a small pin-sized hole in a disk, to a large hole with a thin frame that seems to disappear, like with ghost sights. Some precision target peep sights may also use a front globe sight that is similar to a large aperture that is threaded to accept different shaped posts (Figure 8.6).

Penetration – The distance a projectile embeds itself into a target without passing through.

Perforation – When a projectile passes completely through both sides of a target.

Personal Defense Weapon (PDW) – A very compact automatic, semi-automatic, or select-fire firearm that is similar to a submachine gun, except it fires rifle cartridges.

Picatinny Rail – Also known as MIL-STD –1913, STANAG 2324, or tactical rails, a standardized bracket used on firearms to mount accessories. Picatinny rails consist of a series of hills with a T-shaped cross-section



Figure 8.7– Because the Picatinny rail is standardized by the military there is a huge selection of aftermarket accessories available to mount. Optics, lasers, lights, grips, bipods and even other firearms are available with Picatinny mounts.

and flat notches or “spacing slots.” Each notch is 5.23mm wide and 3mm deep with a center-to-center spacing of 10.01mm (Figure 8.7).

Piezo Method – A way of measuring chamber pressure with the use of a quartz crystal. The method relies on piezoelectricity. Certain materials such as crystals, ceramics, and bone will generate a measurable voltage when exposed to stress. The Piezo method is similar to the copper (CUP) crusher method but instead of a copper or lead cylinder a quartz crystal transducer is used. The Piezo method is cheaper to use than the crusher method because its transducers are reusable for the same caliber. The Piezo method is also more accurate than a strain gauge, and is the preferred method of measuring chamber pressure.

Pistol – A firearm that is meant to be operated with one hand. A term used to describe any handgun other than revolvers.

Pistol Grip – A grip used on some long guns that resembles the nearly vertical grip of a pistol. The angle of the grip and its added surface area provide a better gripping area versus a standard wrist. The enhanced grip adds a degree of control and recoil management. Pistol grips can be used both on the forend of a long gun as well as near the trigger. Grips mounted on the forend are used to combat muzzle rise in automatic firearms. Pistol grips are a defining feature of “assault weapons” and are regulated in some states. Placing a forward pistol grip on a pistol will turn it into an AOW, which is regulated by the BATFE under the National Firearms Act.

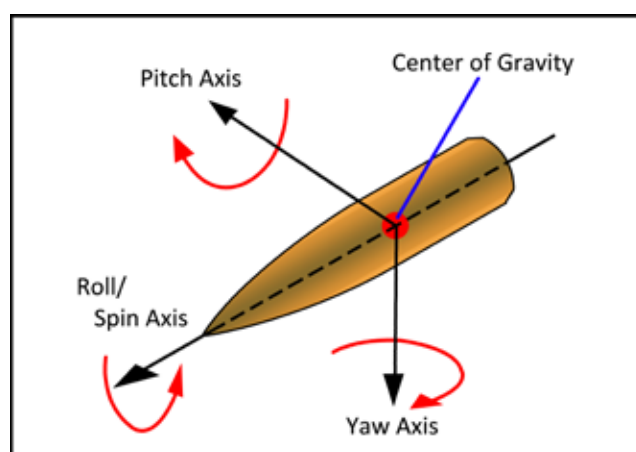


Figure 8.8– During flight a projectile may pitch up and down several times from a reaction to outside forces (air and gravity). The projectile's angular momentum and moment of inertia resist the forces causing the pitch and restabilized it.

Piston-Operated – A type of gas-operated semi-automatic action that uses gas and pistons to cycle the firearm. High pressure gases are routed from the gas port in the barrel into a gas block or other junction. From the block the gases are forced against a piston that pushes the bolt, slide, or connecting rod.

There are two main types of piston systems: long-stroke and short-stroke. With a long-stroke system the piston is attached to the bolt or carrier, and travels the full length of the action's cycling stroke. With a short-stroke or “tappet” system the piston moves independently from the bolt. The piston in a short-stroke system will only travel a fraction of the action's stroke. Piston-operated firearms are typically more reliable than other gas-operated guns because they keep hot gas and propellant debris away from the action allowing it to run cooler and cleaner. Probably the most famous piston-operated firearm of all time is the AK-47, which is known for its legendary reliability.

Pitch – Movement of a projectile's tip up and down. Pitch is rotation along the projectile's lateral or transverse axis. Pitch can be induced by air resistance, turbulence, or by an unbalanced or unstabilized bullet (Figure 8.8).

Plinking – A type of informal target shooting using nonstandard targets like cans, bottles, or any other metallic targets. The term “plink” comes from the noise the target makes when it is hit. The most popular plinking cartridge is the .221 LR because of its ease of use, low price, and availability.

Point of Aim (POA) – The area of the target with which the sights are aligned (Figure 8.9).

Point of Impact (POI) – The precise spot on the target where the projectile impacts. Point of impact is related to point of aim in that they will intersect at two specific distances due to the slight arch of the projectile's trajectory. Point of impact can be adjusted with the use of different height or adjustable sights (Figure 9.0).

Polymer Pistol – A term used to describe a handgun whose receiver is comprised of high-strength polymer materials. Polymer frames usually contain some type of metal components such as rails or reinforcement and are never completely comprised of polymer. The use of polymer over steel or aluminum is advantageous in many categories: less weight, lower felt recoil, and no worries about rust.



Figure 8.9-9.0- Top: Two different points of aim, but the same point of impact (the “x” in the center of the target). The hold to the left is known as a 6 o’clock hold while the one on the right is known as center hold. Bottom: The same point of aim but different points of impact. The pistol on the left shoots to point of aim with great precision. The pistol on the right shoots very precisely but needs a sight adjustment (rear sight moved down and right or front sight moved up and left).

Polygonal Rifling – A type of rifling that uses arch-shaped hills and valleys in a rounded polygonal pattern such as a hexagon or octagon. Polygonal rifling is one of the earliest forms of rifling. Polygonal rifling is often found in match barrels as it has proven to be very precise. It differs from Enfield-style rifling because it does not use the more pronounced lands and grooves. This type of rifling produces less deformation and friction on the bullet, while providing a tighter gas seal. Polygonal rifling is also easier to maintain because there are less crevices to trap fouling. The larger bearing surfaces of the hills also distribute more force over a wider area, reducing stress and increasing barrel life (Figure 9.1).

Porting – 1. Cutting small openings in the top portion of the barrel near the muzzle end. Ports are designed to redirect gas upward in order to counteract muzzle rise. 2. Enlarging the port where cartridges eject from to improve reliability of a firearm by reducing the risk of a case getting hung up during ejection.

Pound-Force per Square Inch ((psi/lbf-in²)) – A unit of pressure or stress. It is the pressure of one pound of force exerted against one square inch.

Powder – A term to describe propellant used in modern firearms. Powder is not actual powder, it is more ball, flake, or tubular in shape.

Powder Charge – The amount of propellant loaded into a cartridge, usually expressed in grains. Also known as a load.

Powder Efficiency – The measurement of the ability of a given propellant to create energy per unit of weight. Powder efficiency is used to establish the maximum performance of energy and velocity and the minimum powder load and chamber pressure.

Powder Residue – After ignition, the remains of any propellant inside the cartridge case, chamber, and bore. Smokeless propellants, especially ball powders, leave minute residues, but they are sometimes very difficult to remove.

Power Factor (PF) – A measurement used to determine the momentum of handgun bullets used in competition. Power factor is often used in competitions sponsored by the IDPA, IPSC, Steel Challenge and USPSA. Power factor can be divided into two classes: minor and major. Minor power factor ranges from 125 –164, while major starts at 165 and over. To calculate power factor you need the bullet weight in grains (w), multiplied by the velocity (v) in feet per second, divided by the constant 1000. For

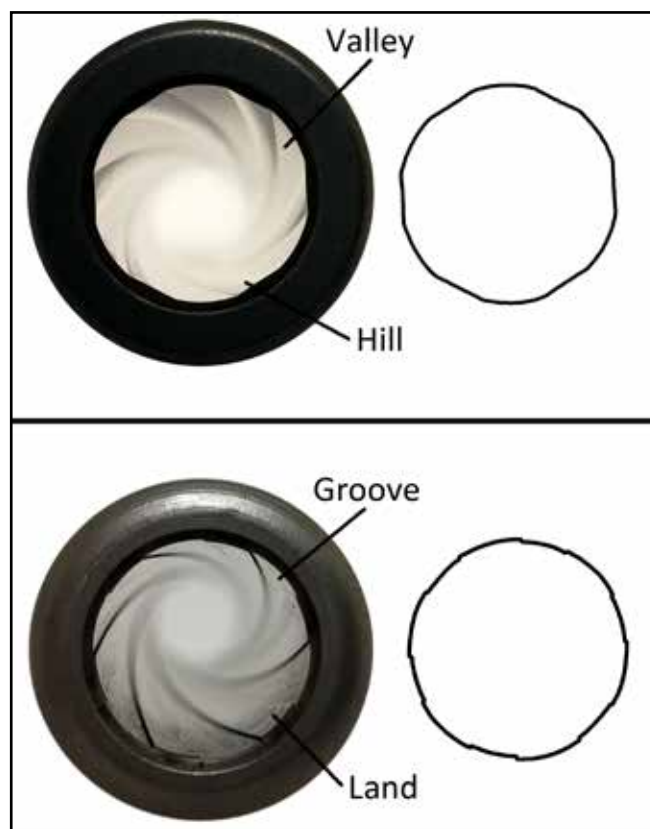


Figure 9.1- The smooth shapes and transitions of the hills and valleys lead to greater velocity and easier cleaning.

example, a 9x19mm bullet weighing 115 (w) grains and travelling at 1,155 (v) fps would look like this:

$$\begin{aligned} 115 \text{ (w)} \times 1,155 \text{ (v)} / 1000 &= \text{PF} \\ 13,2825 / 1000 &= \text{PF} \\ 132.825 &= \text{PF} \end{aligned}$$

A power factor of 132.825 would put this cartridge under the minor class.

Precession – A change in the orientation of a projectile's rotational axis, when one end of the axis is fixed. Precession of a projectile will appear as if it were tracing a cone. An example of precession can be witnessed while watching a spinning top toy. When spin is introduced to the top it stays upright due to its moment of inertia. It will stay upright until it is acted upon by an outside force such as air resistance or gravity. When the top loses momentum it will begin to wobble around the point its spinning on. This wobble is known as precession (Figure 9.2).

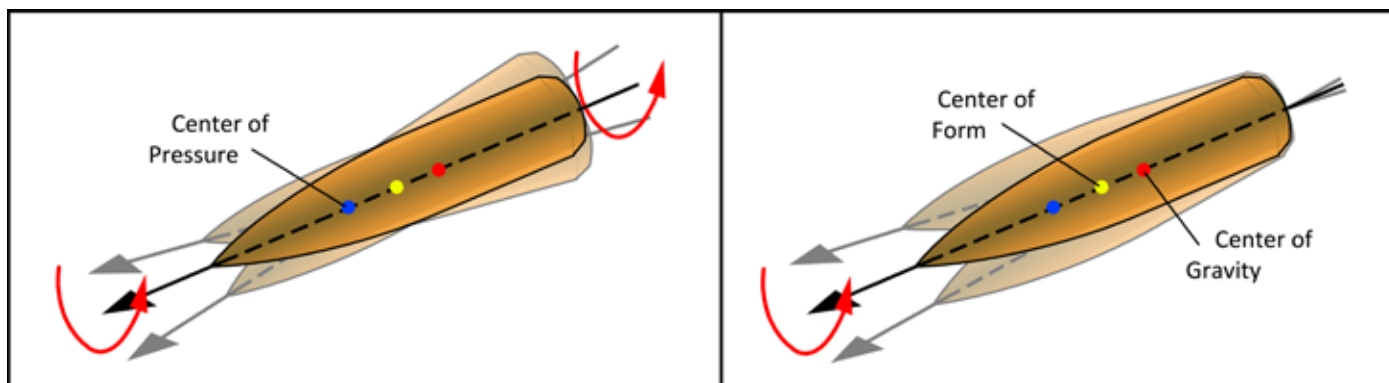


Figure 9.2- On the left the projectile's movement is known as nutation. Both ends of its axis are rotating around its center of form. On the right the projectile's movement is known as precession. Only one end of the projectile's axis is moving while the opposite is fixed.

Precision – The ability of a firearm, ammunition or combination of the two to consistently produce tight, repeatable groups. Precision can be associated with accuracy but is not dependent upon it. A firearm or ammunition can have precision without accuracy, vice versa, neither, or both (Figure 9.3).

Primary Explosive – A compound that is easily ignited by friction, heat, impact, or static electricity. A small amount of energy is required to ignite a primary explosive. Primary explosives are used as detonators or triggers for less sensitive explosives such as propellants.

Primer – A small cup filled with an extremely sensitive primary explosive and a small anvil. The primer is pressed into the primer pocket of a centerfire cartridge case. Once the firing pin strikes the primer, its dimple crushes the primary explosive between the anvil and ignites it. The embers travel through the flash hole of the case to ignite a secondary explosive like the propellant charge (Figure 9.4).

Primer Crimp – A small amount of metal on the case head that is folded over the top of the rounded edge of the primer to hold it in place. Crimps are used when there is excessive chamber heat and pressure that could cause an uncrimped primer to “blow” out of the primer pocket. Primer crimps are mostly found in military ammunition intended to be fired automatically.

Primer Cup – A small bowl-shaped container that holds a sensitive primary explosive and an anvil. These three components form the primer.

Primer Indent – The dimple or indentation that is left when the firing pin strikes the primer.

Primer Leak – The escaping of hot gas around the primer. A leak can be identified by burnt propellant smudges on the case head around the primer pocket.

Primer Pocket – The cavity in the cartridge case head where the primer sits.



Figure 9.3- From left to right: Accuracy without precision- Each shot is an accurate representation of point of aim and the center of the target, but the group as a whole is not tight. Precision without accuracy- Each shot is grouped very tightly together, but they are not an accurate representation of point of aim. Accuracy and Precision- Each shot is grouped very tightly around the point of aim.

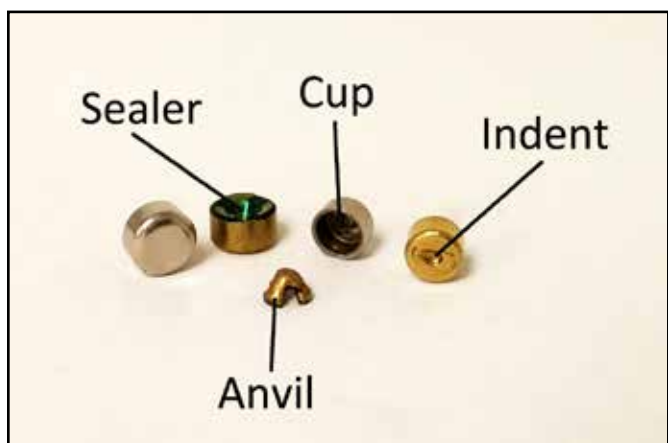


Figure 9.4- These are the component in a Boxer-style primer. A Berdan-style primer uses an anvil that is integral to the case.

Primer Pocket Swaging – Removal of the primer crimp on military cartridges with the use of dies, or a punch-and-base set.

Projectile – An object that is thrust into space by the exertion of force. A bullet is stationary but becomes a projectile when expanding gases force it from the cartridge case, through the bore, and out the muzzle.

Proof – The verification of a firearm's ability to withstand working pressure and stress. High pressure loads (proof loads) with pressures far greater than SAAMI-recommended safe loads are test-fired to ensure that the firearm is capable of withstanding sustained normal pressure loads safely. In the United States individual manufacturers conduct proof testing, while European governments conduct testing by law.

Propellant – A chemical that combines fuel and oxidizer, which when burned produces pressurized gas and heat energy. This energy is used to force an object, such as a bullet or other projectile, through a gun or firearm. Propellant is a general name for chemicals used to create thrust. There are many types of propellants but modern smokeless powders are mostly nitrocellulose-based. Propellant is a secondary explosive which means it is very stable and not subject to unintentional ignition like a primary explosive would be.

Pump-Action – A type of firearm's action commonly found on repeating shotguns or rifles with tubular magazines. A tubular forend that slides back and forth over the magazine is connected to a rod or bar(s) that are attached to the bolt or breechblock. When the forend is operated it cycles the action, ejecting spent cartridges and feeding new ones into the chamber. Also referred to as slide-action or trombone action.

Q

Quad-Barreled – A gun with four barrels. There have been many examples of quad-barreled firearms over the years including production, custom and one-off pistols, rifles and shotguns. The .357 Magnum Derringer pistol is a production version of a quad-barreled firearm (Figure 9.5).



Figure 9.5- The muzzle end of a hand built 16 gauge, quad barreled, break-action shotgun.

R

Race Gun – A firearm that has been modified for precision, reliability, and speed. Race guns are commonly found in most open-type divisions of the most popular handgun competitions. Typical modifications include fitting a match grade barrel with compensator, action and trigger work, electronic sights, and lightening of operating parts for faster function.

Ramped Barrel – Barrels that incorporate an integral feed ramp. A nonramped barrel uses a feed ramp that is incorporated into the frame or receiver. Some barrels made for the government model 1911 have an extended link lug that doubles as a feed ramp. Custom fitting must be done for these barrels to function properly as well as machining of the frame.

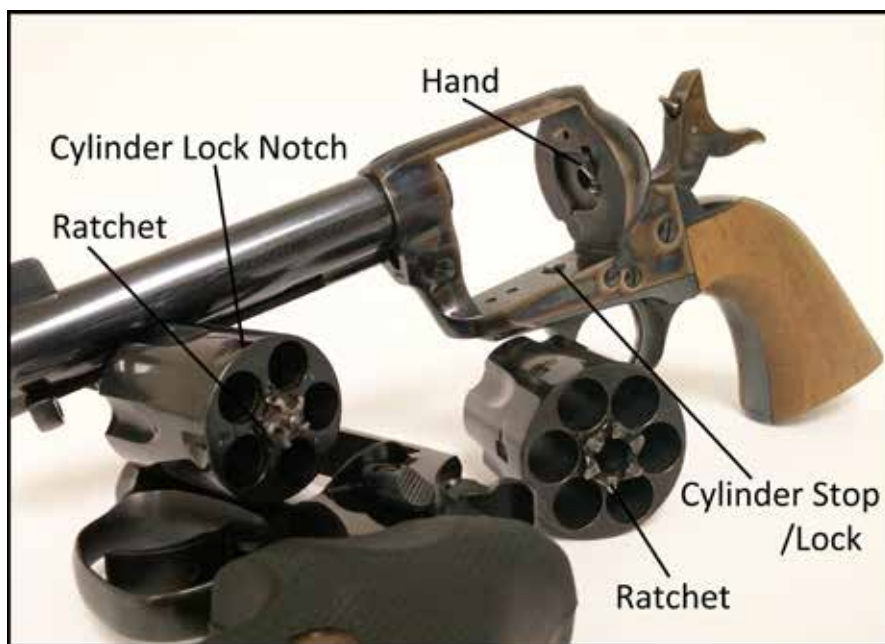


Figure 9.6– When the trigger is squeezed (double-action) or the hammer is cocked (single-action) mechanical linkage pushes the hand out and up against the ratchet. The cylinder will rotate until the chamber aligns with the bore and the cylinder lock secures it.

Ratchet – A notched ring at the center of the rear of the cylinder on revolvers. The ratchet is engaged by the hand and used to rotate the cylinder. Every time the hammer is cocked (single-action) or the trigger is squeezed (double-action) the hand will push against a tooth on the ratchet. When the cylinder rotates it will align a new chamber with the barrel (Figure 9.6).

Ratchet Rifling – A type of rifling that features lands that use one edge that is taller than the other. From the top of the land its face slants down toward the base of the next land. All of the lands combined form a ratchet pattern. Ratchet rifling is a type of canted land rifling (Figure 9.7).

Rate of Fire – A measurement of the rate at which a firearm can cycle and fire cartridges. Rate of fire is expressed in rounds per minute (rpm). An AK-47 has a rate of fire of about 600 rpm where an M16's rate of fire is about 750 rpm. The 20mm M61A2 Vulcan mini-gun has a rate of fire of about 6,600 rpm.

Rebated Rim – A type of cartridge case that has a rim that is a smaller diameter than the body of the case itself.

Receiver – The part of a firearm that houses all or most of the operating parts. The receiver is sometimes referred to as the body, or frame. It is the part of a firearm that contains the serial number, and so is regulated by the U.S. government. The receiver may be composed of polymer, steel, aluminum, or other high-strength alloys. The slide, bolt, or other action parts, fire control group, controls, and magazine well are integrate into the receiver.

Recoil – The rearward force that is thrust upon the shooter during discharge of a firearm. Recoil is a combination of the thrust of the expanding gas exiting the front of the firearm, the energy exerted from the bullet's forward momentum, the weight of the firearm, and the energy of the action cycling (autoloaders only). Recoil is equal to all contributing factors, but in the opposite direction (toward the shooter). Sometimes referred to as kick.

Recoil Buffer (Dampener) – A device used on some firearms to mitigate recoil caused when action parts impact the frame or receiver. Buffers can be made of durable rubber or soft polymer, use springs or cams, and in some more advanced models use pneumatic or hydraulic shocks. Buffers work by dissipating some of the recoil energy that would be transferred to the shooter.

Recoil Energy – A measurement of the force of recoil. Recoil can be easily calculated, all you need to know is the mass (m) of the firearm in pounds, and the recoil velocity (v) of the cartridge. The answer is expressed in foot-pounds of force. The formula for recoil energy is:

$$m \times (v)^2 / 64.348^*(\text{constant}) = \text{recoil energy}$$

Let's use a standard M16A1 that fires a 5.56x45mm cartridge as an example. The M16A1 weighs approximately 6.3 lbs. (m) and uses a 5.56x45mm cartridge with a recoil velocity of 7.43 fps (v). Using the following equation we can calculate recoil energy:

$$6.3 (m) \times 7.43 (v) \times 7.43 (v) / 64.348 = 5.40 \text{ ft-lbf of recoil energy}$$

**The constant is twice the acceleration of gravity: 32.174×2 .*

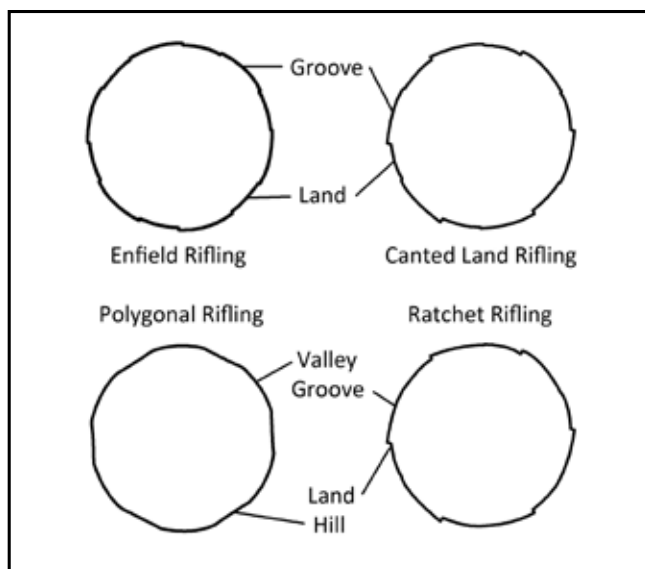


Figure 9.7- The cant of the land on the ratchet rifling is much more pronounced than other canted land rifling types. The shape of the lands reduces friction and increases velocity.

Recoil Operation – A method of cycling a locked breech, autoloading firearms action by using the energy from a discharged round. Recoil operation represents Newton's third law of motion: For every force (the projectile and gas being pushed through the bore) there is an equal and opposing force (the energy used to overpower the recoil spring and cycle the bolt or slide rearward). There are three main types of recoil operation: inertia, long, and short recoil.

Recoil Shield – The portion of a revolver's receiver adjacent to the breech face. The recoil shield is used to prevent cartridges from falling out of the back of the cylinder.

Recoil Spring – A spring used to force the slide or bolt of a semi-automatic firearm back into battery. Upon discharge, the slide or bolt will move back under recoil or other means of operation. The recoil spring will force the slide or bolt forward, stripping a round from the magazine and locking the breech.

Recoil Velocity – The speed at which a recoiling firearm moves. Recoil velocity can be easily calculated, all that is needed is the weight of the bullet (w) in grains, the weight of the propellant (p) charge in grains, the muzzle velocity (mv) of the projectile in feet per second, and the weight of the firearm (m) in pounds. For example, a 5.56x45mm cartridge uses a bullet that weighs 62 grains (w), and a powder charge of about 25 grains (p).

The muzzle velocity of this cartridge is 3,100 fps (mv) and the weight of the firearm is 6.3 lbs. (m). To calculate recoil velocity you use the following formula:

$$p \times 1.75(\text{constant}) + w \times mv / m / 7,000^*(\text{constant}) = \text{recoil velocity}$$

$$25(p) \times 1.75 + 62(w) \times 3,100(mv) / 6.3(m) / 7,000 = 7.43 \text{ fps}$$

Knowing the recoil velocity of a firearm, cartridge combination will also allow you to calculate its recoil energy.

**There are 7,000 grains in 1 pound.*

Red Dot Sight (RDS) – A type of reflex sight that uses a red light emitting diode (LED) to illuminate an aiming point on a viewing window. Typical red dot designs use a convex viewing window that has been coated to reflect only the red spectrum of light back toward the operator. The coated window acts like a collimator and aligns the light rays parallel to each other and the firearm. The use of solid-state LED illuminator requires much less power to operate, which means the red dot sight is very rugged, and has a very long battery life. Red dot sights also tend to be near or parallax-free, allowing the operator to put the dot over the target for point of aim, regardless of the dot's alignment or position in the viewing window. Red dots also focus the target and reticle on the same optical plane, allowing a single point of focus with both eyes open (Figure 9.8).

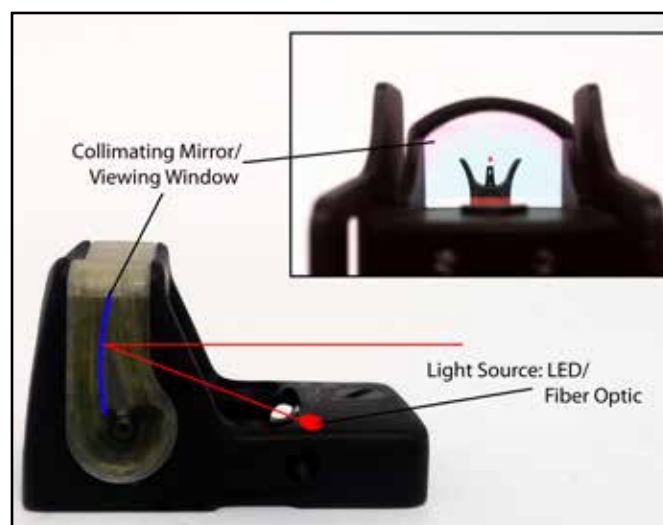


Figure 9.8- Modern day red dot sights are very rugged and extremely reliable. Most quality red dots can handle up to 5000 + G forces and be mounted on pistol slides and high power rifles.

Reflex Sight – A type of sighting system that uses an illuminated projection of a reticle focused at infinity on a viewing window. The reticle image is superimposed onto the field of view and the target. On a firearm, the reticle is focused at infinity at an imaginary point that runs parallel with the barrel and bore axis. The reticle will remain in alignment with the firearm regardless of the operator's eye alignment with the viewing window, removing the parallax that is experienced by other sighting devices. Reflector sights were invented in 1900 and have found used on an array of hosts, such as small arms, antiaircraft guns, fighter aircraft, surveying equipment, telescopes, and camera viewfinders. Reflector sights set the groundwork for today's modern red dot sights, and heads-up displays (HUD). Also known as a reflector sight.

Reload – Replacing the consumable parts of a spent cartridge in order to reuse it. Bullets, propellant, and primers are all replaced in order to recharge the cartridge. Brass cases can be reloaded multiple times (5–15) depending on the caliber and wear imparted on the case.

Reloading Press – A machine that uses a lever-operated ram and dies to load ammunition. When the arm is operated up and down it forces a case into interchangeable dies that perform different functions. There are dies that are used for resizing, depriming and repriming, seating, and crimping. There are also attachments that are used to fill cases with propellant.

Remaining Energy – The amount of energy that is transferred by a projectile when impacting a target. Since a projectile in flight will experience many opposing forces that will leach its energy, its remaining energy is always less than its muzzle energy. A projectile's remaining energy is dependent upon its remaining velocity. Remaining energy is only one component in the science of terminal ballistics. Also known as stopping power.

Remaining Velocity – The amount of velocity that is retained by a projectile before impacting a target. A projectile's remaining velocity is dependent upon many factors including altitude, air resistance, and ballistic coefficient. Remaining velocity is an important factor for a projectile's energy when impacting a target. Remaining velocity is part of the science of terminal ballistics.

Repeating Firearm – Any firearm that is capable of firing more than once without the need for reloading. Repeating firearms use some type of magazine, fixed or detachable or a cylinder in the case of revolvers. Repeatedly cycling cartridges can be done manually, with a bolt-action, or automatically with an autoloader.

Reprime (Recap) – Seating a new primer into the primer pocket of a case. Repriming is one step in the process of reloading.

Resize – Restoring a fired cartridge case to original dimensions. Resizing is accomplished by using a die and press to reshape the case.

Resonance – When a material oscillates with greater amplitude at some frequencies than at others. The frequencies at which a material's oscillating amplitude is greatest are its resonance frequencies. Resonance is the instrument from which all waves and vibrations are created. The “ping” we hear when metal is struck comes from brief resonant vibrations.

Reticle – The fine lines, hairs, or dots that denote the aiming point. There are many variations of the reticle from simple encircled dots or crosshairs to more advanced reticles. Modern day design features include reticles that compensate for drop, and drag of specific calibers. Reticles can also be comprised of fine fibers, etchings in glass, or reflected light (reflex sight) (Figure 9.9).

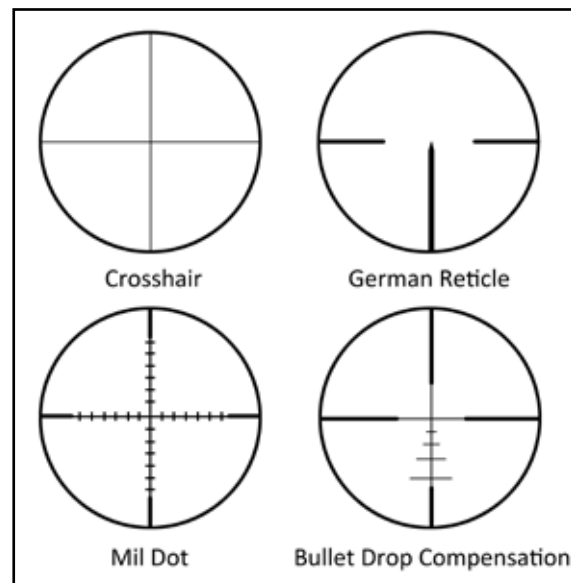


Figure 9.9– Four different types of popular reticles. The top two feature very simple reticles, while the bottom two feature marks and hash lines that can be used to measure target size and distance as well as compensate for wind or movement.



Figure 10.0- Three different types of revolvers used for different purposes. Clockwise from bottom right: A small frame “snub” nose revolver chambered in .38 Special, used for concealed carry. A late 19th century single-action revolver chambered in .45 Long Colt, used for cowboy action competition shooting. A beautiful custom Smith and Wesson model 64-5 chambered in .38 Special, used for target shooting. Custom 64-5 built by Tim Corwin of Corwin’s Gunsmithing in Lakewood, Colorado.

Revolver – A type of repeating handgun that uses a rotating cylinder instead of a magazine. The cylinder contains many chambers, all of which can house individual cartridges. As the cylinder rotates, it aligns each chamber with the bore in preparation for firing (Figure 10.0).

Ricochet – When a projectile bounces, skips or rebounds off of a surface. Ricochets are dependent on many factors, including projectile composition, design, and velocity, as well as target composition and angle of impact.

Rifle – A firearm that has been designed to be gripped with two hands and supported by the shoulder. The BATFE requires that a rifle must possess a minimum 16 in. barrel with an overall length of 26 in. Rifles differ from shotguns because they feature rifling in their barrels. Rifles will typically be chambered for low and high velocity projectiles ranging from .17 –.50 caliber and above.

Rifled Slug – A heavy lead projectile with helical grooves cut around its circumference. The rifling on the slug does not impart any rotation on the projectile but rather reduces the amount of bearing surface against the bore, reducing friction and increasing velocity.

Rifling – A series of spiral grooves cut or formed into the bore of a firearm's barrel. The purpose of the rifling is to impart rotation onto the projectile, creating gyroscopic stabilization. Rifling has many designs from Enfield

rifling and its lands and grooves, to polygonal rifling with less pronounced hills and valleys. Rifling can also vary in the number of grooves cut and the rate of which the spiral pattern creates one revolution, also known as twist rate (Figure 10.1).

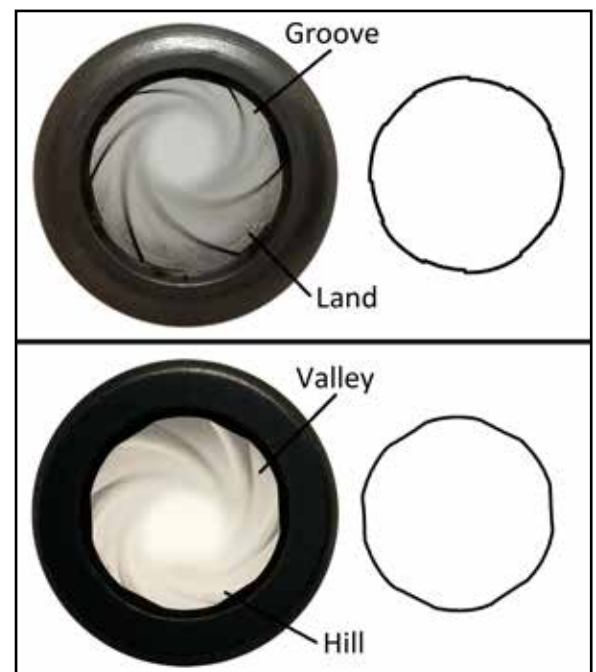


Figure 10.1- Two very different types of rifling. The top is the more conventional Enfield type, with sharp lands and grooves. The bottom polygonal rifling has much softer transitions between its hills and valleys.

Rim – The flange of a cartridge's case head that protrudes out from the base. The rim is used as a gripping surface for the extractor to pull the case from the chamber. On some calibers the cartridge will headspace against the rim.

Rimfire Cartridge – Some of the earliest metallic cartridges. The case is formed from a copper or brass disk that is shaped into a cup with a rimmed base. The rim's diameter extends past the diameter of the case. Once the case is formed, priming compound is put into the rim. Ignition is accomplished by crushing the rim instead of a primer like in a centerfire cartridge.

Rimless Case – A cartridge whose rim is the same diameter as its body. Extraction is accomplished by use of a groove above the rim (Figure 10.2).

Rimmed Case – Any cartridge case whose rim is a larger diameter than its body. Most rimmed cartridges will headspace against the rim.

Rolling Block – A type of single-shot firearm's action that utilizes a semicircular breechblock that rotates back to open the chamber for loading and unloading. The block then rolls forward to lock the breech in preparation for discharge. One of the most famous rolling block rifles was built by the Remington Arms Company.

Rotation – The spin that is imparted upon the projectile along its longitudinal axis (tip to base) by a firearm's rifling. Rotation is controlled by the velocity of the projectile and the twist rate of the rifling. Also known as roll or spin. Rotation can be calculated with muzzle velocity (mv) in feet per second, and twist rate (t) in

inches and expressed in rotations per minute (RPM). For example, a projectile traveling at 3100 fps out of a 1:7 twist barrel would have a rotation speed of:

$$mv \times 720^* (\text{constant}) / t = \text{rpm}$$
$$3,100 \times 720 / 7 = 318,857.14 \text{ rpm}$$

This means if the projectile travels for one minute at a constant velocity it will make about 320,000 full revolutions around its axis.

**1 foot per second = 720 inches per minute*

Rotary Magazine – A type of box magazine that stores cartridges around a sprocket-shaped follower that is mounted parallel to the barrel. When loaded, the cartridges sit between the teeth of the sprocket and rotate around its axis. A torsion spring is used to force the cartridges around the sprocket in preparation for feeding. Rotary magazines are typically very low capacity (10 or less) and may be fixed or detachable.

Rotational (Angular) Momentum – A product of mass spinning around a fixed axis and its rotational velocity. A spinning top is kept upright and stabilizes because of its angular momentum and the moment of inertia. These forces are what stabilize a projectile in flight. A projectile spinning around its longitudinal axis (tip to base) will not deviate in the direction its axis is pointing until acted upon by an internal or external force. These forces may introduce nutation and precession to the axis of the projectile. The direction of deviation is not parallel to the force. Instead it will act by moving 90 degrees in the direction of its rotation.



Figure 10.2– Several types of rimless pistol and rifle cases. Most semi-automatic firearms are chambered in cartridges that used rimless cases.



Figure 10.3– Various round nose bullets. Even though the two on the right are semi-pointed, they are still classified as round nose. From left to right: .22 caliber lead round nose, .351 (9mm) caliber jacketed round nose, .351 caliber cutaway, .451 caliber lead round nose, .308 caliber jacketed round nose, .311 caliber jacketed round nose.

Round – A term used to describe one cartridge.

Round Nose – A type of bullet with a blunt, rounded tip used for deep penetration. A round nose bullet will penetrate further than a hollow point due to its lack of expansion; in fact it is more likely to perforate the target (Figure 10.3).

S

Sabot – A device used to hold a bullet centered in a precise location when its diameter is less than the bore's diameter. When the sabot reaches the end of the muzzle, drag exerted upon it causes it to separate from the projectile. The sabot is also used to create a seal for the bore and bullet creating good obturation and generating higher velocities. Sabots can be constructed from plastic for small bore firearms or aluminum for cannons, or even paper maché or wood.

Safety – A single part, assembly of parts, or mechanisms that are designed to prevent a firearm from being discharged, intentionally or unintentionally. Safeties are used to block or disengage the sear, trigger, hammer, or firing pin and can be found alone or combined together to provide redundant protection. There are also magazine safeties that disengage the trigger when a magazine is not inserted.

Saltpeter (Potassium Nitrate) – A nitrogen-containing chemical compound. Saltpeter or KNO_3 is one of the main components of black powder. Saltpeter can be found in natural mineral form or in organic form, such as bat guano.

Sawed Off Shotgun (Scatter Gun) – A shotgun, usually a side-by-side or over-under whose barrel has been shortened to less than the legal 18 in. length. Sometimes, the stock is also cut down or replaced with a pistol grip to create a shorter overall length. The shortened barrel allows the shot charge to spread wider at closer distances. The overall size and weight allow it to be maneuvered more easily in confined spaces. Shortening the barrel and using a pistol grip sacrifices a considerable amount of recoil control from the loss of weight and support. Also sawed off shotguns do not typically use sights so the operator has to “point shoot,” usually from the hip.

Scabbard – A protective sheath used to carry a rifle or shotgun on horseback or attached to other gear (Figure 10.4).

Scatter Load – A shotshell load that is designed to produce a wide pattern. Scatter loads are used for small game and upland bird hunting in dense cover at close range.

Scope – A device used to magnify the target image. A scope is basically a telescope that uses a reticle for aiming. Also known as a telescopic sight.



Figure 10.4- The scabbard may come with various built-in carry methods. This scabbard features a sling and provisions for mounting to packs and other gear.

Scope Mount – A mechanism used to attach a telescopic sight to a firearm. Scope mounts will consist of a base that attaches to the receiver, and rings or clamps that are used to secure the sights tubular body (Figure 10.5).

Scout Rifle – A class of bolt-action carbines that are very light and compact. They feature a forward mounted scope with long eye relief and possibly a detachable box magazine as well as some type of practical sling. A scout rifle is typically chambered in .308 Winchester. The idea of the scout rifle was popularized by its biggest supporter Col. Jeff Cooper because of its ability to complete many tasks equally well.

Sear – A part or component that holds the hammer or striker in the cocked position. Pulling the trigger will directly or indirectly disengage the sear and allow the hammer/firing pin or striker to contact the primer, firing the cartridge.

Seat – A term used in reloading to describe placing a bullet inside a case in the proper depth.



Figure 10.5- There are two main sizes of scope mount ring diameters (1 in. and 30 mm) and several base attachment types (direct, weaver, picatinny, rotating, etc.).

Sectional Density (SD) – The ratio of a bullet's mass to its cross-sectional area. Sectional density represents a projectile's ability to penetrate. The higher a bullet's SD, the greater its ability to penetrate. Sectional density is a product of mass and bullet diameter and is not affected by shape. Sectional density is one factor when determining a bullet's ballistic coefficient. Sectional density can be calculated using the bullet's weight (w) in grains and its diameter (d) in inches squared. For example, a 62-grain (w) bullet with a .224 in. diameter (d) would have a SD of:

$$SD = 62 (w) / 7,000^* (\text{constant}) \times .224 (d) \times .224 (d)$$

$$SD = 62 (w) / 351.23$$

$$SD = .176$$

**7,000 grains = 1 pound*

Selective Fire – A firearm that allows the operator the ability to change between semi-automatic, burst, or automatic fire, by means of a switch or other mechanism. Selective fire firearms fall under the same category as machine guns and so are regulated by the BATFE.

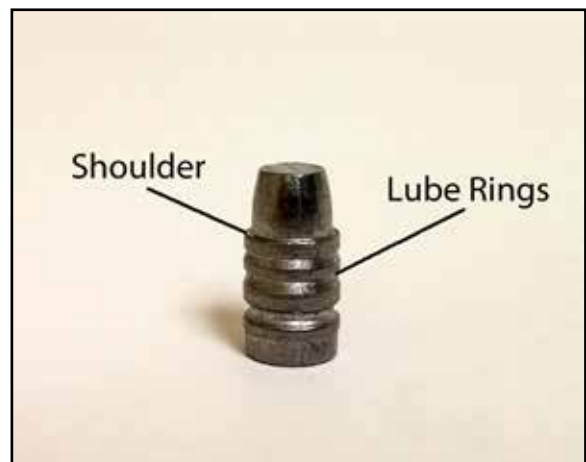


Figure 10.6- A semi-wadcutter bullet has better exterior ballistics and a higher ballistic coefficient than a conventional flat-faced wadcutter, while still performing the same task.

Semi-Automatic – A type of action used in autoloading firearms that fires one cartridge for every trigger squeeze. Once fired, the action will extract and eject the case, disconnect the trigger, and cock the hammer or striker. The action will then close and feed a new cartridge into the chamber, and lock the breech. The firearm cannot be fired again until the trigger is released into its reset position, reconnecting the trigger mechanism.

Semi-Wadcutter – A bullet that features a flat or round nose and a sharp shoulder. The purpose of the semi-wadcutter is to cut clean holes through paper for easier scoring of matches, while providing better external ballistics than a wadcutter bullet and its flat nose (Figure 10.6).

Set Screw – A small screw used on some types of trigger mechanisms that is used to adjust the amount of pressure that is required to release the sear. Set screws are found most commonly on competition- and match-style firearms.

Shooting Bench – A table or platform that is used as a stable shooting surface for use with or without shooting bags or a rest.

Shooting Range – A specialized facility used to train and practice shooting firearms. Shooting ranges can be indoor or outdoor and possibly restrict certain types of firearms, calibers, or bullet designs. Indoor ranges will

feature some type of ventilation system to deal with lead and propellant gas exposure. All ranges will feature a backstop behind the target area made of some type of sloped wall or berm to stop projectiles from perforating the stop or ricocheting.

Shooting Stick (Stake) – Portable firearm rests that may have from one to three legs. Shooting sticks are used by hunters, snipers, or target shooters to stabilize the front of the firearm. Shooting sticks provide a higher degree of accuracy and precision than operator stabilization alone. Most modern shooting sticks are adjustable for height and may feature spring-loaded extension.

Short Action – 1. In a revolver, a modified fire control group that features a hammer with a shorter travel stroke. The shorter stroke leads to a lighter trigger squeeze and faster cycling of the action. 2. In rifles, a receiver that is designed for a shorter-than-standard cartridge. For example, a Remington 700 bolt-action rifle uses a long action receiver for the 7.62 x 51 NATO cartridge, which is 2.8 in. long, and a short-action receiver for the 5.56 x 45 NATO cartridge, which is 2.2 in. long.

Short-Barreled Rifle (SBR) – An automatic or semi-automatic rifle whose barrel is shorter than 16 in. Short-barreled rifles are useful inside of confined spaces such as houses, or vehicles. SBRs are easy to maneuver

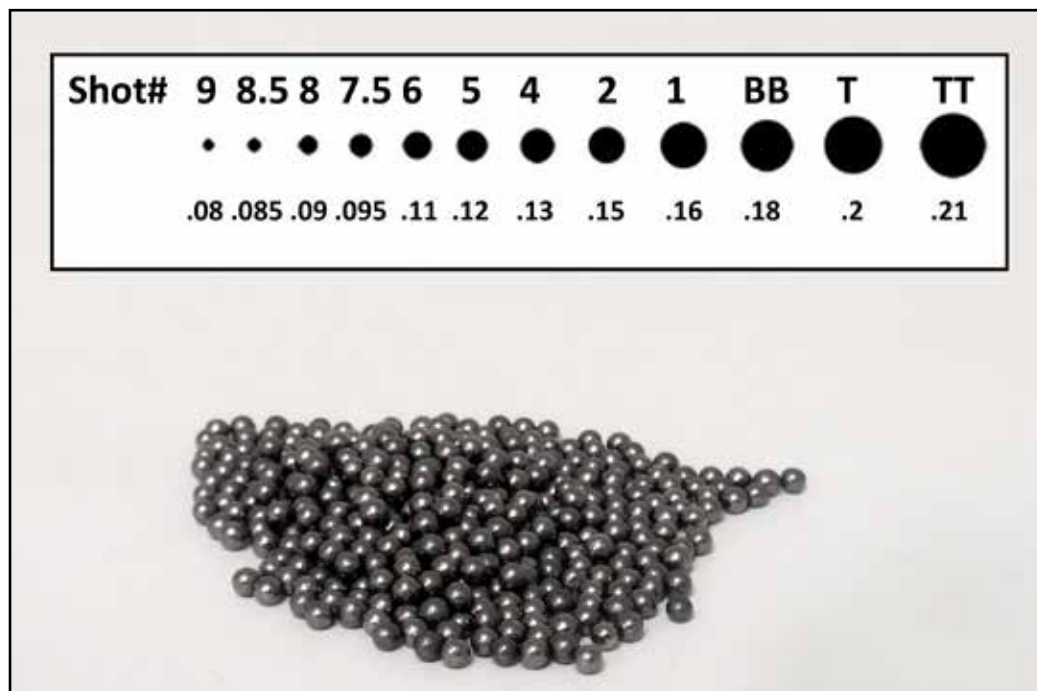


Figure 10.7– Shown is 1½ oz. of #7.5 shot from a 2 ¾ in. 12 gauge cartridge. Drawing is not to scale.

because they are typically lighter than rifles with longer barrels. SBRs are replacing the submachine gun in many roles because they use a more powerful cartridge in a comparable-sized package. Adding a stock to a pistol automatically classifies it as a short-barreled rifle, which is regulated under the National Firearms Act (NFA) and controlled by the BATFE.

Short Recoil – A type of firearms action in which the barrel and breech or slide stay locked and move to the rear a short distance under recoil before unlocking. Once unlocked, the barrel may remain in a rearward position or spring back into position awaiting the return of the breech or slide back into battery.

Shot – Spherical pellets loaded into shotshells. Shot can be composed of lead or steel and is produced by dripping molten metal through perforated plates into water. Shot can range in size from .05 in. with #12 shot up to .2 in. with “T” shot (Figure 10.7).

Shot Pattern – The dispersal of shot when fired into a target. The shot pattern is used to find point of aim, and shot density. Shot pattern is usually measured by the amount of shot that falls within a 30 in. circle at 40 yd.

Shot String – The dispersion of shot in flight. The shot travels in an elongated string rather than a flat disk. Sometimes a shot string can be as long as 15 ft.–16 ft.

Shotgun – A type of firearm that is supported by the hands and shoulder and features a smooth bore and a legal barrel length of 18 in. or over. There are many different shotgun actions from break, pump and lever, to automatic and semi-automatic box magazine fed. Shotguns are designed to fire shotshells and have an effective range from about 40 yd. out 150+ yd. depending on projectile selection.

Shotshell – A cartridge that is designed for use in a shotgun. A shotshell contains a paper or plastic case, propellant charge, wad, cup, shot or other projectile, and a primer. Modern shotshells often use a combined wad and shot cup. Modern shotshells may contain shot, buck, slugs, rubber projectiles, bean bags, flash bangs, signal flares, flechettes, bolos, and even incendiary materials that spew flames and sparks.

Shoulder – The sloped or rounded portion of a cartridge case below the neck on bottleneck cartridges. Rimless bottleneck cartridges often headspace against the shoulder (Figure 10.8).

Shoulder Stock – A detachable buttstock used on some handguns. Attaching a buttstock to any pistol with a barrel length less than 16 in. automatically classifies it as a short-barreled rifle. Some handguns with historical significance, such as the Mauser Broom handle pistol with detachable shoulder stock, may be classified as a curio or relic.



Figure 10.8- Various centerfire bottleneck cartridges with varying shape, size and angle shoulders. The first four cartridges from the left all headspace against the shoulder while the two to the right headspace against the belt at the bottom of the case.



Figure 10.9- On the left is a post and notch type sight set for a pistol. On the right is a peep/aperture type sight set on a rifle.

Side-by-Side Shotgun – A type of shotgun that arranges two barrels horizontally together. Side-by-side shotguns are typically break-action but in a few rare cases there have been bolt, and pump-actions. Side-by-sides are also known as double barrel shotguns.

Side lock – A type of action found most commonly on side-by-side double barrel shotguns that locates the fire control group on plates on the sides of the inside of the receiver.

Side Plate – A cover plate found on the side of a double-action revolver used to enclose the fire control group in the receiver.

Sight – The apparatus on a firearm that is used as a reference point for aiming. A set of sights is composed of a front and rear sight and are used to align the muzzle

and the receiver with the target. Sights come in many types from notch and post, to bead, peep and aperture (Figure 10.9).

Sight Picture – The visual alignment of the front and rear sights, and the alignment of the sights to the target (Figure 11.0).

Sight Radius (Sighting Plane) – The distance between the rear face of the rear sight and the rear face of the front sight. The longer the sight radius, the easier it is to notice misalignments and precisely align the sights to the target. A longer sight radius may be more precise but it also takes longer to align the sights for a proper sight picture. A shorter sight radius will be faster to align but it will not be as precise.



Figure 11.0- Two different sight pictures but the same intended point of aim/impact (the "x in. in the center of the target). The sight picture on the left is known as a 6 o'clock hold, the one on the right is a center hold. Also, notice that the front sight is the primary focus, leaving the rear sight and target slightly blurry.

Sighting-In – The process of tuning a firearm's sights so that when it is fired the point of impact will intersect the point of aim at a specific distance.

Single-Action (SA) – A type of trigger function where the hammer must be cocked manually before it can be released by the trigger. Unlike double-action triggers, the only function of the trigger is to release the hammer or striker from a cocked position.

Single Base Propellant – A type of smokeless propellant that only uses nitrocellulose (guncotton) as its main explosive compound. Unlike double-base propellants, which use guncotton and a second explosive compound, single-base propellants only use a stabilizer and/or other additives.

Single-Shot – A firearm that holds only one round at a time and must be reloaded after every shot. Single-shot firearms do not feature provisions for a magazine.

Single Stack Magazine – A type of box magazine that arranges the cartridges in a single vertical column (Figure 11.1).

Single-Stage Trigger – A type of trigger action that utilizes a single squeeze with consistent pressure throughout to release the sear mechanism. Single stage triggers use only one sear surface with only a small amount of travel, so they are usually a bit heavier than two-stage triggers to remain safe. Single-stage triggers are also referred to as tactical triggers because of their quick manipulation and short travel. Single-stage triggers are beneficial for situations where fast shooting is required.



Figure 11.1– The single stack magazine is one of the simplest designs for an external box magazine. They tend to be very reliable but lack capacity.

Sizing – A process used in reloading that returns fired cases back to the dimensions of new or unfired cases with the use of dies and a press.

Skeet Gun – A shotgun used in skeet shooting competition. A skeet gun will typically feature a 28–32 in. barrel and will use an over-under or semi-automatic action. Since there is solely a front sight on most skeet guns, it is very important that the stock aligns the eye to the sight and the target. Skeet guns will typically feature a high or adjustable comb and a ventilated rib. They rely on the height of the comb and the rib to adjust the eye and point of aim to point of impact. They will also use a choke specifically for skeet.

Slide – The part of semi-automatic pistol that serves as the bolt or breech and cycles under recoil. The slide houses the firing pin or striker, extractor, barrel, and sights. Under recoil, the barrel will unlock or cam out of the way so the slide can move backward, extracting the case, disconnecting the trigger, and cocking the hammer or striker. On its forward stroke it will strip a new cartridge from the magazine, feed the cartridge, and lock the breech.

Slide Stop – The part of an autoloading pistol that engages the slide and holds it to the rear, either by manual operation or activated by the magazine's follower when it is empty (Figure 11.2).

Sling – A strap that is attached to a firearm for the purpose of carrying, but can also be used to stabilize the firearm during shooting. There are many different sling types that contact the firearm in one, two, or even three places. Slings may be adjustable, and are usually made from leather or nylon.



Figure 11.2– The slide lock will engage when the magazine is empty, notifying the operator that the pistol is empty and ready to accept a loaded magazine.



Figure 11.3- A Foster type, 1 oz., rifled, hollow point, 12 gauge slug.

Sling Swivel – Metal loops that are attached to a firearm for the purpose of attaching a sling.

Slug – A large lead projectile used in shotguns, often for big game hunting. Sometimes a slug will feature rifling like “fins” along its outer bearing surface. The fins are not used to impart rotation upon the projectile; rather, they reduce friction against the bore, leading to higher velocities. There are many different types of slugs with different designs; some have smooth or rifled bodies, some may be jacketed, and some may use a sabot to encompass the slug as it travels down the bore (Figure 11.3).

Small-Bore – A term used to describe .22 caliber and smaller rimfire cartridges and firearms chambered for them.

Smokeless Powder – A propellant that is used for all modern day firearms. Smokeless powder is a high energy fuel that does not require oxygen. Its burning rate is controlled by the size and shape of its kernels and through the use of various additives.

Smoothbore – Any firearm barrel whose bore does not feature rifling. The most common form of smoothbore firearm is the shotgun.

Snap Cap – A cartridge-shaped device used for training and checking the function of firearms. Snap caps are used to check feeding, extracting, and ejecting. Some snap caps feature a spring-loaded or hard plastic primer that will absorb and soften the impact of the firing pin during dry fire practice (Figure 11.4).

Snub Nosed Revolver – A slang term used to describe a revolver with a small or medium frame and a barrel length of less than 2 in.

Soft -Point Bullet – A type of bullet that features a jacket that leaves the soft lead nose exposed. Soft-point bullets are designed to expand on impact due to the rapid deformation of the soft lead nose causing the jacket to unfurl.

Special Occupational Tax (SOT) – A class of tax that is paid by Federal Firearms Licensees under the Internal Revenue Code of 1986. The SOT tax allows certain classes of FFL holders to manufacture, import, and deal in NFA firearms. The SOT is \$1,000 except for those who engage in less than \$500,000 worth of business, in which case the tax is \$500 and must be paid before July 1 of each year.



Figure 11.4- From left to right: .22 Long Rifle, 9x19mm, .223 Remington, 12 gauge.

Speedloader – A device used to aid in loading cartridges into a firearm either into the cylinder or into a box magazine. Speedloaders for revolvers carry cartridges five to six at a time in the precise location to load them simultaneously. Speedloaders for box magazines often hold cartridges stacked into a column in preparation to be stripped into the top of the magazine.

Spitzer Bullet – A bullet that features a conical nose used in intermediate to high-powered rifle cartridges. A design of the late 19th century that revolutionized small arms ballistics because it extended the practical range for a given cartridge as well as providing higher velocities and flatter trajectories. The streamlined shape of the spitzer bullet experiences less drag and provides a higher ballistic coefficient. The name spitzer was derived from the German word *spitzgeschoss*, which means “pointy bullet” and is also known as a spire point.

Sporterizing – A term used to describe modifying a military surplus or military-style firearm for use as a hunting or competition arm. Modifications typically include shortening the barrel and changing or shortening the stock to lighten the firearm for easier handling.

Sporting Arms and Ammunition Manufacturers Institute (SAAMI) – An association of firearm and ammunition manufacturers. SAAMI sets the standards in the industry for ammunition and chamber specifications in the U.S. SAAMI was founded in 1926.

Spotting Scope – A small telescope used to examine shots on distant targets without leaving the firing line. Spotting scopes usually feature magnification from 20X–60X and a tripod with adjustable legs for ease of use.

Stabilize – To generate enough rotational momentum to balance a projectile during flight. The twist rate of the rifling ensures that there is enough rotation generated to properly stabilize the projectile. Once stable, a projectile will not deviate from its trajectory unless acted upon by an outside force.

Standard Deviation (SD) – A method of measuring variations or dispersions from an average. In projectile velocity, standard deviation represents how fast or slow each individual velocity is from the average (mean). Large deviations in velocity can lead to poor grouping, accuracy, and precision. To calculate standard deviation,

all you need is the velocities you are comparing. For example, for the following three velocities:

2,550 fps, 2,560 fps, 2,600 fps

First add all of your velocities together and divide the sum by the number of velocities to get your mean:

$$2,550 + 2,560 + 2,600 = 7,710 / 3 = 2570$$

2,570 is your mean velocity.

Now subtract your mean from each velocity to get your deviation from the mean:

$$2,550 - 2,570 = -20$$

$$2,560 - 2,570 = -10$$

$$2,600 - 2,570 = 30$$

Square the deviations:

$$-20 \times -20 = 400$$

$$-10 \times -10 = 100$$

$$30 \times 30 = 900$$

Add the squared values together and divide by the number of values:

$$400 + 100 + 900 = 1400 / 3 = 466.66$$

Calculate the square root of 466.66 and you get a SD of 21.60 fps for this three-shot group. This means there is a variance of ± 21.60 fps from the mean velocity. This means you can expect velocities from 2,548.4 fps to 2,591.6 fps.

This same formula can also be used to measure the SD of group sizes. Whether using 3- or 5-shot groups, the formula works the same. To measure the standard deviation of group sizes you have to measure the extreme spread of each group. For example: Three 5-shot groups measure 1.3 in., 1.1 in., .8 in.:

$$1.3 + 1.1 + .8 = 3.2 / 3 = 1.06(\text{mean})$$

Subtract your mean from each group:

$$1.3 - 1.06 = .24$$

$$1.1 - 1.06 = 0.04$$

$$.8 - 1.06 = -.26$$

Square each deviation:

$$.24 \times .24 = .06$$

$$.04 \times .04 = .002$$

$$-.26 \times -.26 = .068$$

Add the squared values together and divide by the number of values:

$$.06 + .002 + .068 = .13 / 3 = .04$$

The square root of .04 is .2.

This means there is a deviation of $\pm .2$ in. from the mean group size. The accuracy of the data will increase with the number of instances calculated. Using this data you may soon be able to predict grouping and extreme spread.

Standardization Agreement (STANAG) – A consistency or standardization between the countries of the NATO alliance. The agreements cover processes, procedures, and terms and conditions for common military or technical operations or equipment. The purpose of these standardized agreements is so that one nation may use the supplies and support of other member nations' military. Some of the standardized agreements are based on specifications for firearms and ammunition, as well as mapmaking, communications and classifications.

Star Crimp – The most frequently used closure at the top of a shotshell. The name comes from its appearance. From 6–8 segments are folded to form the pattern. Star crimps are found mostly on shotshells loaded with shot, because they will not close properly on buck or slugs (Figure 11.5).

Steel Jacket – A type of bullet that uses a steel jacket instead of copper. Some militaries around the world use steel jackets instead of copper to save money. Some steel-jacketed bullets use a thin copper coating to protect the bore from excessive wear.



Figure 11.5– A .410 gauge shotshell with a 6 segment crimp on top, a 12 gauge shotshell with an 8 segment crimp on bottom.

Stippling – A process of applying a random pattern of small craters, dimples or pits for the purpose of creating a gripping surface. Stippling can be applied to metal or wood with a hammer and punches with different tip sizes and profiles. Stippling can also be molded into plastics during the casting process or afterward, with some types of polymers and rubbers (Figure 11.6).

Stock – The portion of a rifle or shotgun that houses the barrel, receiver, and breech assembly. The stock is comprised of a forend, grip, comb, and buttstock. The top of the butt is the heel and the bottom is the toe. Some stocks may also feature a hole behind the grip for the shooting hand thumb to pass through, providing a better



Figure 11.6– The stippling on the rubber grip on the right matches the stippling on the polymer forend and grip on the left. With specialty cutting bits or punches the same pattern can be applied to metal and wood.

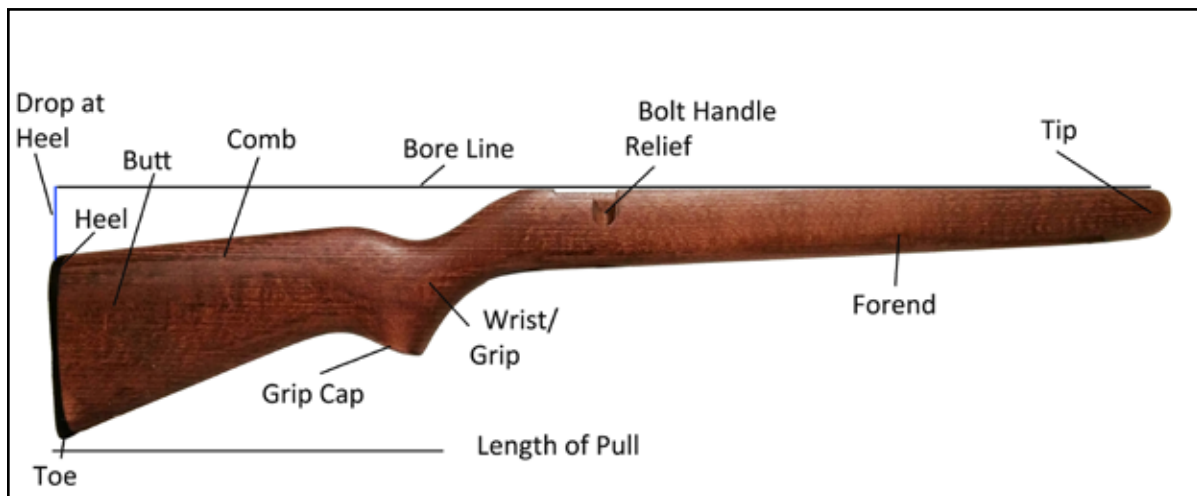


Figure 11.7- A commercial grade walnut stock for a bolt-action, rimfire rifle.

grip. Stocks are usually composed of wood, but some may be plastic or even high strength composite (Figure 11.7).

Stopping Power – The ability of a firearm's projectile to reliably incapacitate a target. Stopping power is directly affected by a projectile's design as well as the velocity at which it travels. Stopping power is linked to bullet energy, hydrostatic shock, and energy transfer.

Straight-Pull Action – A type of bolt-action where the bolt is manipulated straight back and forward. Straight-pull differs from other common bolt-action designs because its bolt does not rotate to lock the chamber.

Strain Gauge – A device used to measure stretch in a material. The typical strain gauge uses a metallic foil conductor with a flexible backing that attaches to a receiver. In firearms, a strain gauge can be used to measure chamber pressure. The gauge is attached to the outside of the chamber of the barrel with specialized glue or epoxy. During firing, internal chamber pressure causes the barrel to stretch slightly, creating strain in the gauge. This strain will cause the electrical resistance to change. This change is received by the device and converted to a pressure figure, usually in psi.

Striker – A type of spring-loaded firing pin with a sear surface that does the job of the hammer too. Strikers are generally heavier than firing pins and may be found as one- or two-piece constructions. Before firing, the striker is held in cocked position under spring compression until the trigger releases the sear, sending the tip of the striker into the primer (Figure 11.8).

Stripper Clip – A type of speedloader that uses a strip of metal or plastic to hold cartridges in preparation for loading into a magazine. Usually the strips are held in place by a slot in the bolt or receiver and the cartridges are slid down into the magazine, then the clip is removed. Bolt-action rifles such as the Enfield 303, Mauser K98, or semi-automatic rifles, such as the SKS, all use stripper clips.

Sub-Machine gun – An automatic or select-fire carbine that uses pistol caliber cartridges. Sub-machine guns typically have very short barrels and a short overall length. They are used primarily for close-quarter battle (CQB) because of their compact size. An example of a sub-machine gun is the Heckler & Koch MP5 chambered for the 9mm parabellum cartridge.

Subsonic – A projectile that is traveling at speeds below the speed of sound (768 miles per hour or 1,125fps).

Supersonic – A projectile that is traveling faster than the speed of sound (768 miles per hour or 1,125fps).



Figure 11.8- Two different types of strikers from two different striker-fired, polymer pistols.

Suppressor (Moderator) – A device that is attached to the muzzle end of the barrel that is used to reduce noise and flash signatures. Suppressors are usually cylindrical in shape and feature baffles and expansion chambers to slow and trap expanding gas and flame, reducing both noise and flash. Some suppressors are designed to quickly attach to the end of the barrel and some may be integral with the barrel and are not so easily removed. Also known as a silencer.

T

Take-Up – The initial movement of the trigger and trigger connector/s before engaging the sear release mechanism. Take-up is most commonly found in two-stage triggers. Take-up is also known as slack.

Takedown Lever – A part used on some semi-automatic pistols for the purpose of disassembly. Once actuated, the lever will release the slide assembly from the frame or receiver.

Takedown Rifle – A rifle that easily assembles and disassembles for transport or storage. The barrel and receiver easily unscrew or have some sort of quick detach mechanism.

Tang – A metal band or bar that extends from the rear of a rifle or shotgun's receiver that attaches the action to the stock. The tang also serves to reinforce the stock in its weakest point — the wrist.

Target Pistol – A pistol that is specially modified to be highly precise. Typical modifications include lighter action and fire control parts for lower recoil and a faster lock time. Other modifications such as adjustable sights, grips with thumb rests, heavy barrels, and short, light triggers are common on target pistols.

Target Rifle (Match Rifle) – A competition rifle that uses a heavy adjustable stock with an adjustable cheek piece, and a grip with thumb rests and palm swells. Other features include hand stops or other modifications used to create balance and control recoil.

Taylor Knockout Factor (TKOF) – A mathematical formula for evaluating the stopping power of projectiles used for big game hunting. Renowned African game hunter John Taylor developed this formula to estimate the capabilities of cartridges and their ability to humanely dispatch large game animals such as lions, tigers, elephants, and hippos. The formula favors large diameter, heavy bullets because Taylor believed they were better suited for big game. The formula uses bullet mass in grains (m), multiplied by bullet velocity in feet per



Figure 11.9- A variable power 3-9x40 rimfire rifle scope.

second (v), multiplied by bullet diameter in inches (d), divided by the constant, 7,000*:

$$\text{TKOF} = m \times v \times d / 7,000$$

For example a 5.56x45 cartridge uses a .224 diameter, 62-grain bullet traveling at 3,100 fps. Using the formula its TKOF would be:

$$62 \times 3,100 \times .224 / 7,000 = 6.15$$

The .22 long rifle has a TKOF of about 1.33 while the 50 BMG has a TKOF of about 147.

*7,000 grains = 1 pound

Telescopic Sight – A type of firearm sight that consists of a refracting telescope with a reticle image placed in the optical axis of the sight. The reticle is superimposed on the same optical plane as the target, and provides a magnified precise view of point of aim. Also known as a scope or magnified optic (Figure 11.9).

Telescoping Stock (Collapsible) – A type of buttstock that is adjustable for length by means of a locking rail system. Telescoping stocks are useful for adjusting the length of pull of the firearm for different shooting positions, as well as storage, and use inside of small spaces, like a vehicle or bedroom (Figure 12.0).

Temperature Effect – The change in a projectile's velocity based on the change in surrounding temperature. A projectile will travel further through warm, low pressure, low density air, than cold, high pressure, high density air. The cold, high density air will exert more drag than the warmer, less densely packed air.



Figure 12.0- Most telescoping stocks have multiple stop points to tailor the length of pull to the shooter or situation.

Terminal Ballistics – A part of the science of ballistics that deals with the projectile upon impacting the target. Terminal ballistics can be affected by the design of the projectile and its composition, as well as the target's composition and design.

3/5 Land Rifling – A type of polygonal rifling that uses three or five hills and valleys. The use of an odd number of lands and grooves prevents the rifling from exerting a compressive or “pinching” force on the bullet. This pinching force will create more friction and deformation, leading to lower velocities and suffering accuracy and precision. The increased surface dimensions of the three lands and grooves lends to longer barrel life due to more surface area spreading wear from friction, heat, and pressure.

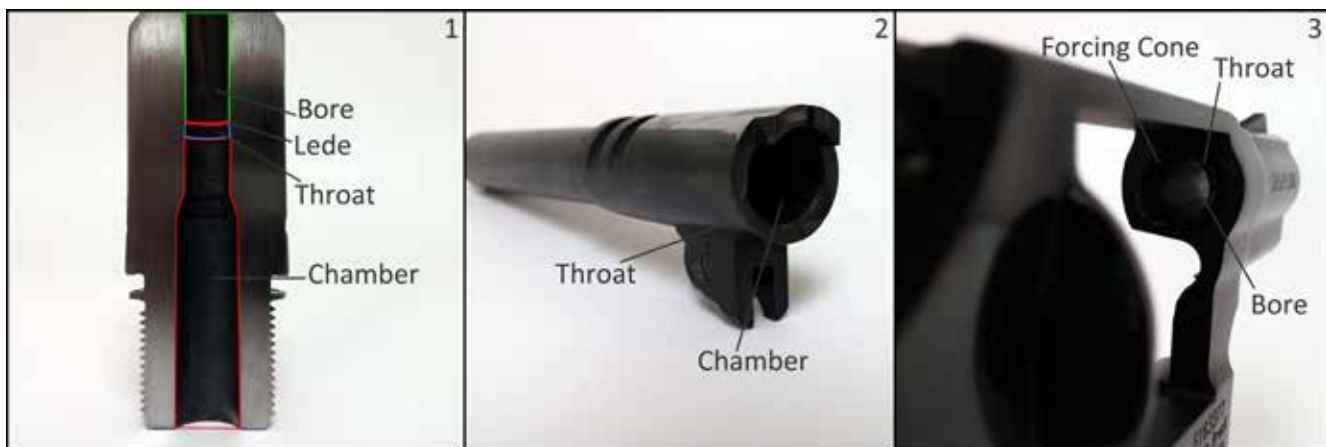


Figure 12.1- 1. In a rifle barrel the throat serves to guide the projectile from the cartridge case into the bore. 2. In a semi-automatic pistol barrel the throat serves to guide a cartridge into the chamber in preparation for firing. 3. In a revolver barrel the throat serves to guide the projectile into the bore from the chamber, past the cylinder gap.

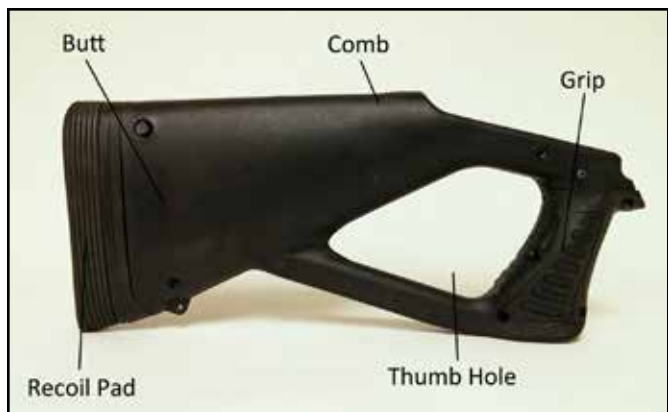


Figure 12.2- An aftermarket thumbhole stock for a pump-action shotgun.

Throat – 1. In all firearms except revolvers, the area just ahead of the chamber before the lede and rifling. 2. In revolvers, the area at the breech end of the barrel that guides the bullet from the chamber (Figure 12.1).

Thumbhole Stock – A rifle or shotgun stock that uses a pistol-style grip that is attached to the stock in such a manner that it leaves a hole in it for the thumb to wrap the grip (Figure 12.2).

Thumb Rest – A raised surface on the sides of a firearm's grip, shaped to support and align the thumb for a proper grip.

Time of Flight – A measurement of the time it takes a projectile to travel a given distance. Time of flight is a factor in external ballistics and will be affected by air resistance, the altitude effect, ballistic coefficient, drag, drop, and temperature effect. Time of flight can be calculated using the muzzle velocity (m) in feet per second, the velocity of the projectile at the target (v) in feet per second, and the distance of the target in feet (d). The formula is as follows:

$$m + v / 2 = \text{average velocity (av)}$$

$$d / \text{av} = \text{time of flight in seconds}$$

A projectile that leaves the muzzle at 3,100 feet per second and reaches a target 1,500 feet away with a remaining velocity of 2,000 feet per second will have a flight time of:

$$3,100 (m) + 2,000 (v) / 2 = 2550 (\text{av})$$

feet per second average velocity

$$1,500 (d) / 2,550 (\text{av}) = .58 \text{ seconds}$$

of flight time.

Toe – The bottom corner of the rear of the buttstock (Figure 12.3).

Trajectory – The path of the projectile from the muzzle to the target. Trajectory is the path of the projectile's momentum. Trajectory can be affected by air resistance, drag, drift, drop, or changes in velocity or time of flight.

Transitional Ballistics – Part of the science of ballistics that deals with the projectile from the time it leaves the muzzle until there is no longer any force from expanding gases acting upon it. Transitional ballistics lies between internal and external ballistics. Usually expanding gases are at pressures far greater than atmospheric pressures. Once the bullet leaves the muzzle and breaks the obturation seal, these gases are free to move past the muzzle and expand in any direction. The shape of the muzzle's crown has a very large impact on transitional ballistics. Expanding gas that is not evenly directed around the projectile will affect its trajectory.

Transfer Bar (Lever) – A type of safety used in modern revolvers. When the trigger is squeezed the transfer bar will move between the hammer and firing pin. When the hammer falls, it will hit the transfer bar, transmitting its energy to the firing pin. The transfer bar will drop out of the way when the trigger is back in its reset position. The transfer bar will prevent an accidental discharge from a drop or parts breakage.

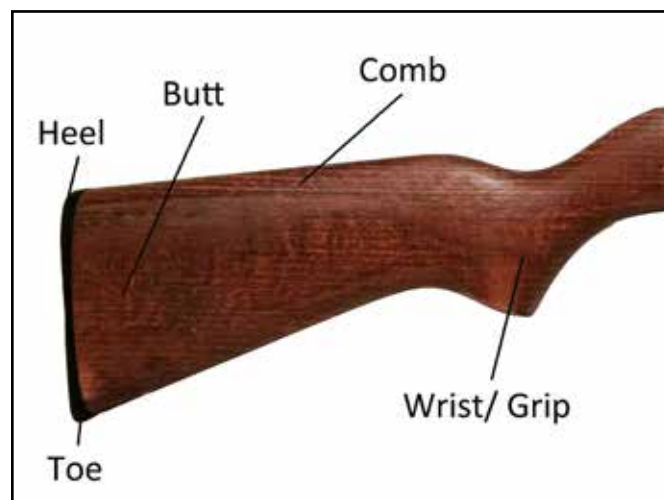


Figure 12.3- The toe sits opposite of the heel on the butt of the stock. The angle from the heel to the toe can affect how the firearm points when shouldered.

Transonic Problem – A condition that occurs when a supersonic projectile approaches subsonic speeds. Transonic speeds range from 600–768 miles per hour (880–1,126 fps). The rapid deceleration of speed causes the projectile's center of pressure to shift forward. This shift creates a slight wobble in the projectile. If the projectile has been properly stabilized it will overcome the wobble with only a slight deviation in point of impact. If the projectile is not properly stabilized, then the wobble will become so severe that it will begin to tumble.

Trap Gun – A shotgun, usually an over-under but sometimes an auto loader, that features a fully choked barrel with a length between 28 in. and 30 in. Trap guns are specifically built for trap shooting so they are equipped accordingly. Most trap guns will feature a longer, straighter stock than a normal shotgun, a soft rubber buttpad, and a ventilated rib that extends almost the whole length of the barrel.

Trigger – The part of a firearm that is used to initiate the process of ignition. When the trigger is squeezed, it directly or indirectly disengages the hammer or striker sear and allows the primer to be struck. There are two main trigger shapes: flat or curved. Outside of the shape of the trigger there are also different actions such as single-action (SA) and double-action (DA), as well as different systems such as single-stage and two-stage triggers. There are some firearms that are SA only or DA and there some semi-automatic pistols and revolvers that feature a trigger that is DA and SA.

Trigger Break – The exact moment when squeezing the trigger; releases the sear and initiates ignition. The amount of take-up, creep and over-travel, as well as the weight of the trigger, will affect the feel of the break. A long, heavy trigger with lots of over-travel will affect accuracy and precision in a negative way by allowing more room for disruption before, during, and after the break. For optimum accuracy and precision the break should be short, fairly light (2–3.5 lb.) and exhibit little to no over-travel. The break should also be very consistent from one squeeze to the next and feel very crisp, like breaking a glass rod.

Trigger Guard – A loop or ring that surrounds the trigger of a firearm to prevent accidental discharge from incidental contact. On lever-action rifles the trigger guard doubles as the lever.

Trigger Reach – The distance from the rear of the grip to the face of the trigger in its forward most position. Trigger reach is a measurement most common with handguns. Trigger reach is an important measurement for fitting handguns of various sizes to hands of various sizes.

Trigger Spring – A small spring used in the fire control group that returns the trigger to its reset position after discharge.

Trigger Stop – A device that prevents the trigger from traveling any further than is needed to release the sear. Trigger stops are used to prevent a condition known as over-travel. A trigger stop may be found on the trigger itself or on the frame behind the trigger and are often adjustable.

Trunnion – 1. On tubular or stamped receivers, it is used as a coupler for the barrel and receiver. On an AK-47 there is a front and rear trunnion that are either welded or riveted in place. The front trunnion accepts the barrel and the rear trunnion accepts the buttstock assembly. 2. A term for a rod-like protrusion from either side of a cannon or other gun that is used as a mounting or pivot point for use on a carriage or vehicle.

Tubular Magazine – In a repeating rifle or shotgun, a pipe-like structure that is mounted to the barrel and receiver. It contains a spring and a follower and is used to hold cartridges in a nose-to-tail configuration in preparation for feeding.

Tumble – 1. The process of agitating bullets or cases with some sort of abrasive compound or material for the purpose of cleaning or polishing. Most commonly associated with reloading. 2. A condition that happens when a projectile becomes destabilized and begins to flip nose over tail. This destabilization can come from an improper twist rate or because of the transonic problem. An FMJ bullet may also tumble when impacting some materials such as soft tissue. The tumble is caused when the heavier base carries more momentum than the lighter nose, causing it to flip.

Turnbolt Action – The most common type of bolt-action that must be rotated to manipulate the action. The turnbolt action gets its name from the way the bolt handle must be turned to lock the locking lugs into recesses in the receiver. The turnbolt action is favored over the straight-pull action because of its increased strength and ability to handle very high power magnum cartridges. Lee-Enfield and Mauser made rifles that were very successful and made the turnbolt action popular.

Twist Rate – The distance a bullet must travel through the rifling in order to complete one full rotation. Twist rate is expressed in one rotation in x inches. Slower twist rates, such as 1 in 20 in., impart less rotation on a projectile than a 1 in 7 in. Longer bullets require a faster twist rate than shorter bullets of the same caliber. Traditional ball-shaped projectiles require far slower twist rates to stabilize than modern spitzer bullets.

Two-Stage Trigger (Double Pull) – A type of trigger action that uses two unique phases. The first stage is usually very light in comparison to the second stage and represents the majority of the trigger's travel. At the end of the first stage, there is a “wall” where the second stage starts. The second stage requires slightly more pressure to travel a slight distance, releasing the sear and beginning the firing sequence. The purpose of a two-stage trigger is to allow a crisp, smooth break without sacrificing safety. The two-stage trigger is beneficial for slow, precision shooting.

U

Underlug – On revolvers, it is an integral housing on the underside of the barrel that is used to protect the ejector rod. On some S&W revolvers it houses the forward portion of the cylinder locking mechanism (Figure 12.4).

United States Military Standard (MIL-STD/MIL-SPEC) – A military standard that ensures products meet certain requirements: commonality, reliability, compatibility with logistics systems, and similar defense-related objectives. The standards serve to create interoperability so that all military products meet certain requirements regardless of manufacturer.



Figure 12.4– The channel under the barrel houses the ejector rod while the cylinder is closed.

V

Variable Choke – See *Adjustable Choke*.

Varmint Rifle – A small caliber firearm (.17 or .22) or a high-power air gun used to hunt varmints, such as rats, house sparrows, starling, crows, ground squirrels, gophers, jack rabbits, marmots, groundhogs, porcupine, opossum, coyote, skunks, weasels, or feral cats, dogs, goats, pigs and other animals considered to be nuisance vermin. Varmints are hunted because they are destructive to native or domestic plants and animals.

Velocity – A measurement of a projectile's speed, usually expressed in feet per second. The velocity of a projectile is a large contributing factor to its kinetic energy. Since a projectile's mass is constant, the amount of energy it possesses will vary with its velocity. A projectile will be at its highest velocity the moment it exits the muzzle and will continue to slow until it impacts a target or is pulled to the ground by gravity. Velocity can be affected by drag, lift, gravity and mass.

Ventilated Rib – A thick metal band that runs the length of a shotgun barrel and is attached by several evenly spaced risers. The rib serves as a sighting plane for the solitary front sight. The rib also helps to dissipate barrel heat during continuous and rapid firing (Figure 12.5).

Vertical Angles – Angles up or down that a projectile is fired at. The angle that a projectile is fired from can change its anticipated point of impact. Gravity acts perpendicular to the earth's surface. When a projectile is fired at a steep angle, it will travel a shorter horizontal distance than its line-of-sight distance. The shorter



Figure 12.5– This rib serves to align the operator's eye with a specific point of aim. The mid bead and front bead prevent horizontal deviation.

flight time means gravity will have less time to act on the projectile, resulting in a higher point of impact than expected. Firing uphill or downhill will always result in a higher point of impact than point of aim (Figure 12.6).

Vibration – A phenomenon where oscillations occur in a material and its structure. Vibrations are like a series of waves passing through and transferring energy to a material. Vibration is an undesirable effect of discharging a cartridge. Heat and pressure waves are transmitted through the barrel and action in the form of vibration. These vibrations can be erratic, making accuracy and precision difficult.



Figure 12.7– Different wad types and materials. Clockwise from top left: two paper wads, a plastic wad with integral cup spacer, and two plastic wad/gas seals.

W

Wad – A saucer that is used as a divider or buffer inside of shotshells. A wad can be integral with the case or hull to mount and support the head, or used to separate the propellant from the shot. It can also be used to cover the shot in preparation for crimping. A wad can be made of paper, felt, plastic, or other material. Most modern day shotshells feature a plastic wad that is integral with the cup (Figure 12.7).

Wadcutter – A type of bullet design that features a completely flat nose and very sharp shoulder. A wadcutter bullet is used for target shooting because the bullet's design cuts near perfect holes in the paper and allows for more precise scoring.

Wax Slug – A type of improvised frangible slug. Wax slugs are made by mixing shot with wax. The wax holds the shot together in the shape of a slug. Upon impact the shot fragments dramatically. To make a wax slug you

need to cut the top off of a shotshell just below the crimp. Then you pour out the shot into a container and mix it with paraffin wax. Scoop the wax/shot mixture back into the case and allow it to dry. Once dry, you can level the top of the case off with a file or sandpaper. It is important to note that excessive wax buildup can lead to overpressure issues and a potentially dangerous situation.

Weaver Rail – A type of mounting platform for optical sights or accessories. The weaver rail features a T-shaped cross-section with a slot cut in it to accommodate a locking screw to clamp the accessory to the rail. Weaver rails differ from Picatinny rails because they are not standardized in the size or spacing of the slots. Accessories designed for Weaver rails will fit Picatinny rails but accessories designed for Picatinny rails may not fit Weaver rails.

Web – The flange inside of a cartridge case that separates the primer pocket from the case interior.

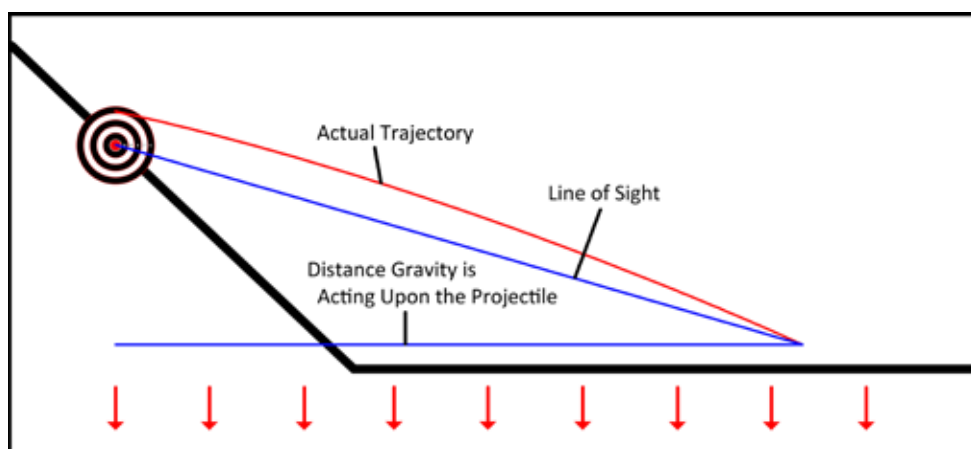


Figure 12.6– To correct trajectory for shooting up or down hills you must hold low of your intended target. The amount of hold under is dependent on the angle of deviation from horizontal.

Wildcat Cartridge – A custom cartridge that is modified from a commercially available cartridge in order to develop higher velocities, greater energy, less recoil or more consistency. Modifications include necking up or down to change the caliber of parent case for increased bullet size or increased velocity from a smaller diameter bullet. Necking back pushes the neck further down the case, reducing size and capacity, making it possible to convert a rifle cartridge into a pistol cartridge. Blowing out creates more case capacity. Reducing the angle of the shoulder or case taper so it is squarer creates an interior case profile that is beneficial for a more consistent propellant burn. Wildcatting is beyond the ability of the average enthusiast or reloader because it requires specialized tooling and processing necessary for forming the cases and cutting the chambers.

Wind Drift – A change in a projectile's trajectory in response to wind. Wind can affect a projectile in many ways depending on its direction. A crosswind blowing from either side will cause a projectile to drift in the direction of the wind. This drift does not come from the wind pushing the side of the bullet, but rather from drag. When a projectile encounters a crosswind, it will experience a change in its center of pressure. This pressure shift will cause the nose of the bullet to turn into the wind and its base to face down wind. Since the wind is acting nearly parallel to the projectile, drag forces it downwind in its direction of travel.

A headwind or tailwind will affect a projectile's drop. Headwind acting against the bullet's nose will increase the amount of drag being exerted. This will cause a decrease in velocity and an increase in drop. A tailwind pushing against the base of the bullet will have an opposite effect, with a slight increase in velocity and a decrease in drop. In the real world, wind does not act perfectly parallel or perpendicular to the projectile. Winds blowing from different angles will cause deviation in the vertical and horizontal travel of the projectile (Figure 12.8).

Windage – The lateral adjustment of the sights to compensate for wind drift. Also refers to the friction that is applied to the projectile either by air resistance or blowing wind.

Wrap Around Grip – A grip or grip sleeve that wraps around the frame or wrist of a firearm to provide a more secure gripping surface. The grip will usually envelope both sides of the grip and wrap either the front or back strap or in the case of a grip sleeve, both. Wrap around grips are typically made of rubber and also help to reduce some felt recoil.

Wrist – The part of a rifle or shotgun stock that is gripped by the firing hand. The wrist is the weakest part of a rifle's stock as it is the portion of the stock that is slimmest and faces the most strain. Sometimes the wrist is attached to the receiver with a tang, which also serves to reinforce it.

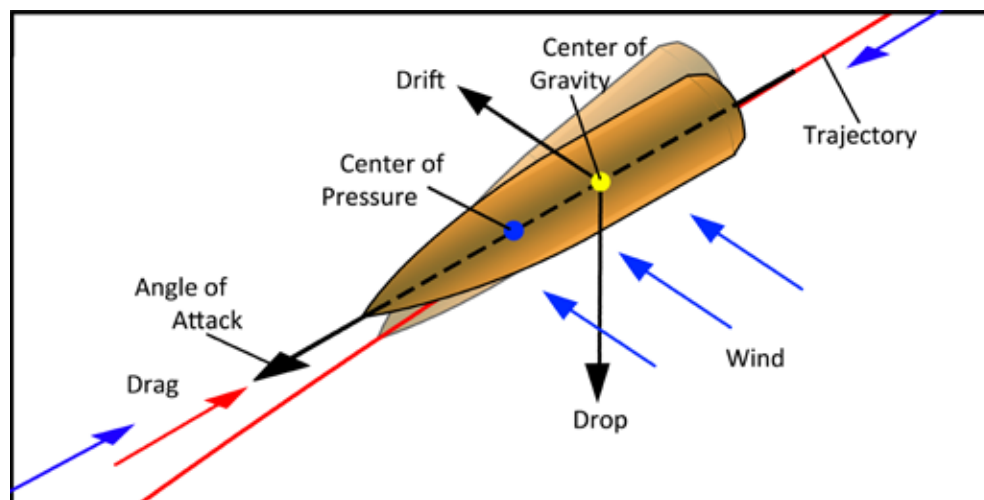


Figure 12.8- Wind can alter a projectile's trajectory from any direction in various different ways. Wind will also affect a projectile differently based on its rotation.

X

X-Ring – A small circle at the center of a bull’s-eye target that represents the highest scoring value used for pistol and small-bore rifle shooting competitions.

Y

Yaw – Sideways movement of the tip of a projectile. In external ballistics, yaw refers to how rotation causes bullets to spin away from their intended trajectory. Yaw is caused by rotation of a projectile around its vertical axis that is caused by rotational momentum around its longitudinal axis. Yaw can also be caused by crosswinds or an unbalanced projectile that was not properly stabilized (Figure 12.9).

Z

Zero/Zeroing – The sight setting at which point of aim and point of impact will coincide at a given range. The process of zeroing sights.

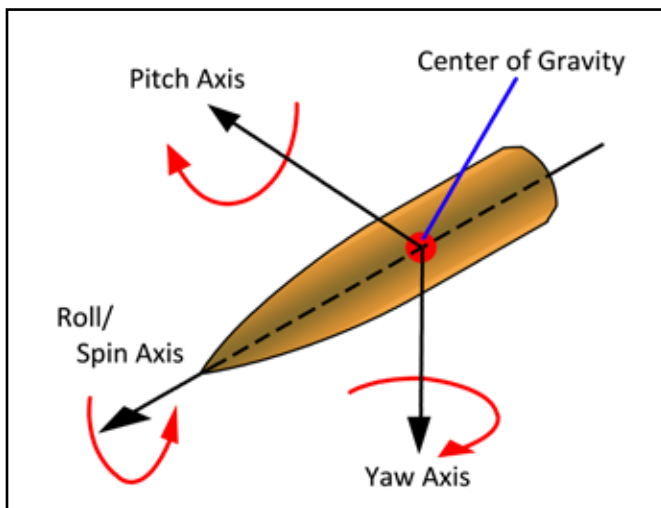


Figure 12.9- A projectile will yaw and pitch several times throughout its flight. A properly stabilized projectile will overcome this movement and recover its trajectory unless acted upon by an outside force (wind).

